# AR TARGET SHEET

The following document was too large to scan as one unit, therefore, it has been broken down into sections.

EDMC#:

0062811

**SECTION:** 

9 OF 15

DOCUMENT #:

WA7890008967 Rev 8

TITLE:

Hanford Facility RCRA

Permit, Dangerous Waste

Portion, Rev 008, 9/04

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### 8.0 PERSONNEL TRAINING [H]

- 2 This chapter discusses personnel training requirements based on WAC 173-303 and the HF RCRA Permit
- 3 (DW Portion). In accordance with WAC 173-303-806(4)(a)(xii), the Hanford Facility Dangerous Waste
- 4 Part B Permit Application must contain two items: (1) "an outline of both the introductory and
- 5 continuing training programs by owners or operators to prepare persons to operate or maintain the TSD
- 6 facility in a safe manner as required to demonstrate compliance with WAC 173-303-330" and (2) "a brief
- description of how training will be designed to meet actual job tasks in accordance with the requirements
- 8 in WAC 173-303-330(1)(d)." The HF RCRA Permit, (DW portion) Condition II.C (Personnel Training)
- 9 contains training requirements applicable to Hanford Facility personnel and non-Facility personnel.
- 10 Compliance with these requirements at the Liquid Effluent Retention Facility and 200 Area Effluent
- 11 Treatment Facility is contained in both Hanford Facility RCRA Permit, Attachment 33, Chapter 8.0
- 12 (DOE/RL-91-28) and this chapter. This chapter supplements Attachment 33, Chapter 8.0
- 13 (DOE/RL-91-28).

### 14 8.1 OUTLINE OF INTRODUCTORY AND CONTINUING TRAINING PROGRAMS

- 15 The introductory and continuing training programs are designed to prepare personnel to manage and
- maintain the TSD unit in a safe, effective, and environmentally sound manner. In addition to preparing
- personnel to manage and maintain TSD units under normal conditions, the training programs ensure that
- personnel are prepared to respond in a prompt and effective manner should abnormal or emergency
- 19 conditions occur. Emergency response training is consistent with the description of actions contained in
- 20 Attachment 34, Chapter 7.0, Contingency Plan. The introductory and continuing training programs
- 21 contain the following objectives:
- Teach Hanford Facility personnel to perform their duties in a way that ensures the Hanford Facility's compliance with WAC 173-303
- Teach Hanford Facility personnel dangerous waste management procedures (including
- 25 implementation of the contingency plan) relevant to the job titles/positions in which they are
- 26 employed, and
- Ensure Hanford Facility personnel can respond effectively to emergencies.

### 28 8.1.1 Introductory Training

- 29 Introductory training includes general Hanford Facility training and TSD unit-specific training. General
- Hanford Facility training is described in Attachment 33, Section 8.1 (DOE/RL-91-28), and is provided in
- 31 accordance with the HF RCRA Permit (DW Portion), Condition II.C.2. TSD unit-specific training is
- 32 provided to Hanford Facility personnel allowing those personnel to work unescorted, and in some cases is
- 33 required for escorted access. Hanford Facility personnel cannot perform a task for which they are not
- 34 properly trained, except to gain required experience while under the direct supervision of a supervisor or
- 35 coworker who is properly trained. Hanford Facility personnel must be trained within 6 months after their
- 36 employment at or assignment to the Hanford Facility, or to a new job title/position at the Hanford
- 37 Facility, whichever is later.
- 38 General Hanford Facility training: Refer to description in Attachment 33, Section 8.1 (DOE/RL-91-28).
- 39 Contingency Plan training: Hanford Facility personnel receive training on applicable portions of the
- 40 Hanford Emergency Management Plan [Attachment 4 of the HF RCRA Permit (DW Portion)] in general
- 41 Hanford Facility training. In addition, Hanford Facility personnel receive training on content of the
- description of actions contained in contingency plan documentation in Attachment 34, Chapter 7.0 to be
- able to effectively respond to emergencies.

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- 1 Emergency Coordinator training: Hanford Facility personnel who perform emergency coordinator duties
- 2 in WAC 173-303-360 (e.g., Building Emergency Director) in the Hanford Incident Command System
- 3 receive training on implementation of the contingency plan and fulfilling the position within the Hanford
- 4 Incident Command System. These Hanford Facility personnel must also become thoroughly familiar
- 5 with applicable contingency plan documentation, operations, activities, location, and properties of all
- 6 waste handled, location of all records, and the unit/building layout.
- 7 Operations training: Dangerous waste management operations training (e.g., waste designation training,
- 8 shippers training) is determined on a unit-by-unit basis and considers the type of waste management unit
- 9 (e.g., container management unit) and the type of activities performed at the waste management unit
- 10 (e.g., sampling). For example, training provided for management of dangerous waste in containers is
- different than the training provided for management of dangerous waste in a tank system. Common
- training required for compliance within similar waste management units can be provided in general
- training and supplemented at the TSD unit. Training provided for TSD unit-specific operations is
- identified in the training plan documentation based on: (1) whether a general training course exists,
- 15 (2) the training needs to ensure waste management unit compliance with WAC 173-303, and (3) training
- 16 commitments agreed to with Ecology.

### 17 8.1.2 Continuing Training

- Continuing training meets the requirements for WAC 173-303-330(1)(b) and includes general Hanford
- 19 Facility training and TSD unit-specific training.
- 20 General Hanford Facility training: Annual refresher training is provided for general Hanford Facility
- 21 training. Refer to description in Attachment 33, Section 8.1 (DOE/RL-91-28).
- 22 <u>Contingency plan training</u>: Annual refresher training is provided for contingency plan training. Refer to
- 23 description above in Section 8.1.1.
- 24 <u>Emergency coordinator training:</u> Annual refresher training is provided for emergency coordinator
- 25 training. Refer to description above in Section 8.1.1.
- 26 Operations training: Refresher training occurs on many frequencies (i.e., annual, every other year, every
- 27 3 years) for operations training. When justified, some training will not contain a refresher course and will
- 28 be identified as a one-time only training course. The TSD unit-specific training plan documentation will
- 29 specify the frequency for each training course. Refer to description above in Section 8.1.1.

### 30 8.2 DESCRIPTION OF TRAINING DESIGN

- 31 Proper design of a training program ensures personnel who perform duties on the Hanford Facility related
- 32 to WAC 173-303-330(1)(d) are trained to perform their duties in compliance with WAC 173-303. Actual
- 33 job tasks, referred to as duties, are used to determine training requirements. The first step taken to ensure
- 34 Hanford Facility personnel have received the proper training is to determine and document the waste
- 35 management duties by job title/position. The second step compares waste management duties to general
- 36 waste management unit training curriculum. If general waste management unit training curriculum does
- 37 not address the waste management duties, the training curriculum is supplemented and/or on-the-job
- training is provided. The third step summarizes the content of a training course necessary to ensure that
- 39 the training provided to each job title/position addresses associated waste management duties. The last
- step is to assign training curriculum to Hanford Facility personnel based on the previous evaluation. The
- 41 training plan documentation contains this process.
- Waste management duties include those specified in Section 8.1 as well as those contained in
- 43 WAC 173-303-330(1)(d). Training elements of WAC 173-303-330(1)(d) applicable to the Liquid
- 44 Effluent Retention Facility and 200 Area Effluent Treatment Facility operations include the following:

- 1 Surface Impoundment (Liquid Effluent Retention Facility)
- 2 Procedures for using, inspecting, repairing, and replacing emergency and monitoring equipment
- 3 Key parameters for automatic waste feed cut-off systems
- Communications or alarm systems
- Response to fires or explosions
  - Response to groundwater contamination incident
- 7 Shutdown of operations.

- 8 Tank system (200 Area Effluent Treatment Facility)
- 9 Procedures for using, inspecting, repairing, and replacing emergency and monitoring equipment
- Key parameters for automatic waste feed cut-off systems
- Communications or alarm systems
- Response to fires or explosions
- Shutdown of operations.
- 14 Containers (200 Area Effluent Treatment Facility)
- Procedures for using, inspecting, repairing, and replacing emergency and monitoring equipment
- Communications or alarm systems
- Response to fires or explosions
- 18 Hanford Facility personnel who perform these duties receive training pertaining to their duties. The
- 19 training plan documentation described in Section 8.3 contains specific information regarding the types of
- training Hanford Facility personnel receive based on the outline in Section 8.1.

### 21 8.3 DESCRIPTION OF TRAINING PLAN

- 22 In accordance with HF RCRA Permit (DW Portion), Condition II.C.3, the unit-specific portion of the
- 23 Hanford Facility Dangerous Waste Permit Application must contain a description of the training plan.
- 24 Training plan documentation is maintained outside of the Hanford Facility Dangerous Waste Part B
- 25 Permit Application and the HF RCRA Permit. Therefore, changes made to the training plan
- documentation are not subject to the HF RCRA Permit modification process. However, the training plan
- documentation is prepared to comply with WAC 173-303-330(2).
- 28 Documentation prepared to meet the training plan consists of hard copy and/or electronic media as
- 29 provided by HF RCRA Permit (DW Portion), Condition II.C.1. The training plan documentation consists
- 30 of one or more documents and/or a training database with all the components identified in the core
- 31 document.
- A description of how training plan documentation meets the three items in WAC 173-303-330(2) is as
- 33 follows:
- 34 1. -330(2)(a): "The job title, job description, and name of the employee filling each job. The job
- description must include requisite skills, education, other qualifications, and duties for each position."
- 36 <u>Description</u>: The specific Hanford Facility personnel job title/position is correlated to the waste
- 37 management duties. Waste management duties relating to WAC 173-303 are correlated to training
- courses to ensure training properly is assigned.
- 39 Only names of Hanford Facility personnel who carry out job duties relating to TSD unit waste
- 40 management operations at the Liquid Effluent Retention Facility and 200 Area Effluent Treatment
- 41 Facility are maintained. Names are maintained within the training plan documentation. A list of
- 42 Hanford Facility personnel assigned to the Liquid Effluent Retention Facility and 200 Area Effluent
- Treatment Facility is available upon request.

- Information on requisite skills, education, and other qualifications for job titles/positions are addressed by providing a reference where this information is maintained (e.g., human resources).
- 3 Specific information concerning job title, requisite skills, education, and other qualifications for
- 4 personnel can be provided upon request.
- 5 2. -330(2)(b): "A written description of the type and amount of both introductory and continuing training required for each position."
- Description: In addition to the outline provided in Section 8.1, training courses developed to comply with the introductory and continuing training programs are identified and described in the training plan documentation. The type and amount of training is specified in the training plan documentation as shown in Table 8.1.
- 13. -330(2)(c): "Records documenting that personnel have received and completed the training required by this section. The Department may require, on a case-by-case basis, that training records include employee initials or signature to verify that training was received."
- 14 <u>Description</u>: Training records are maintained consistent with Attachment 33, Section 8.4, 15 (DOE/RL-91-28).

Table 8.1. 200 Area Liquid Waste Processing Facilities Training Matrix.

			Tr	aining Cate	gory*		
Attachment 33, Chapter 8 Training Category (DOE/RL-91-28)	General Hanford Facility Training	Contingency Plan Training	Emergency Coordinator Training		Operation	s Training	
200 Area Liquid Waste Processing Facilities DWTP implementing category	Orientation Program	Emergency Response (contingency plan)	Emergency Coordinator Training	General Waste Management	Container Management	Tank System Management	Surface Impoundment
Job title/position							
Nuclear Chemical Operators (NCOs)	X	X		X	X	X	X
Shift Technical Advisor (STAs)	X	X					
Shift Operations Manager (SOMs)	X	X	X	·			
Environmental Compliance Officer	X			X			
Resident Waste Service Provider	x			X	X		
Non-Resident Waste Service Provider	X			X			

<sup>\*</sup> Refer to the 200 Area Liquid Waste Processing Facilities Dangerous Waste Training Plan for a complete

description of coursework in each training category. The 200 Area Liquid Waste Processing Facilities Dangerous

Waste Training Plan address the 242-A Evaporator, the 200 Area Effluent Treatment Facility, and the Liquid

<sup>20</sup> Effluent Retention Facility.

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### 11.0 CLOSURE AND FINANCIAL ASSURANCE [I]

2 This chapter describes the planned activities and performance standards for closing LERF and ETF.

### 3 11.1 CLOSURE PLAN/FINANCIAL ASSURANCE FOR CLOSURE [I-1]

- 4 The LERF and ETF will be clean closed with respect to dangerous waste contamination that resulted from
- 5 operation as TSD units, with closure of LERF occurring first. To facilitate closure, the LERF retention
- 6 basins are being viewed as consisting of seven components: the covers and primary liner, drainage layer
- 7 system/bentonite carpet liner, secondary liner, soil bentonite, internal and/or external piping, ancillary
- 8 equipment, and concrete basins. To facilitate closure of ETF, ETF is being viewed as consisting of six
- 9 components: tanks, internal and/or external piping, ancillary equipment, concrete floors/dikes/
- 10 encasements, structures, and soil directly beneath the structure. It is anticipated that closure of LERF and
- 11 ETF will begin after the projected 30-year active life of LERF and ETF. If it is determined that clean
- closure is not possible, the closure plan will be modified to address required postclosure activities.
- 13 Uncontaminated structures will be left for future use or disassembled, dismantled, and removed for
- 14 disposal. Uncontaminated equipment and structures could include aqueous makeup, HVAC and piping,
- steam condensate and cooling water piping, and the control room and office areas.
- 16 Clean closure requires decontamination or removal and disposal of all dangerous waste, waste residues,
- 17 contaminated equipment, soil, or other material established in accordance with the clean closure
- performance standards of WAC 173-303-610(2). This and future closure plan revisions will provide for
- 19 compliance with these performance standards.

### 20 11.2 CLOSURE PERFORMANCE STANDARD [I-1a]

- 21 Clean closure, as provided for in this plan, and in accordance with WAC 173-303-610(2), will eliminate
- 22 future maintenance and will be protective of human health and the environment by removing or reducing
- 23 chemical contamination at LERF and ETF to levels that eliminate the threat of contaminant escape to the
- 24 environment.
- 25 After closure, the appearance of the land where the LERF and ETF are located will be consistent with the
- 26 appearance and future use of its surrounding land areas. This plan proposes to leave clean structures and
- equipment in place after closure for potential use in future operations. This need will be evaluated at the
- 28 time of closure.

29

### 11.2.1 Closure Standards for Metal Surfaces, Rubber, Tanks, and Concrete

- 30 This closure plan proposes use of a 'clean debris surface' (defined in the following paragraph) as the clean
- 31 closure performance standard for the metal surfaces, rubber (i.e., basin covers, liners, etc.), tanks, and
- 32 concrete that will remain after closure. This approach is consistent with Ecology guidance
- 33 (Ecology 1994a) for achievement of clean closure. Additionally, adherence to this guidance ensures that
- 34 all residues have been removed as required by WAC 173-303-640 for clean closure of the ETF tank
- 35 systems. The ETF verification tanks will be considered "clean" if the delisting limits were not exceeded
- 36 for the effluent in the tanks. If the delisting limits were exceeded, closure activities will be as described
- 37 in Section 11.3.4.3.
- 38 The clean debris surface standard is verified visually. "A clean debris surface means the surface, when
- viewed without magnification, shall be free of all visible contaminated soil and hazardous waste except
- 40 residual staining from soil and waste consisting of light shadows, slight streaks, or minor discolorations
- 41 and soil and waste in cracks, crevices, and pits may be present provided that such staining and waste and

- soil in cracks, crevices, and pits shall be limited to no more than 5% of each square inch of surface area" 1
- (40 CFR 268.45). When a physical extraction method is used on concrete, the performance standard is 2
- based on removal of the contaminated layer of debris. The physical extraction performance standard for 3
- concrete is removal of 0.6 centimeter of the surface layer and treatment to a clean debris surface. 4
- Inspections to verify achievement of a clean debris surface will be performed and documented. 5

#### 11.2.2 Closure Standards for Internal and External Piping 6

- The internal and external piping of both LERF and ETF will be flushed and drained as part of closure. 7
- The rinsate will be sampled and analyzed. Results less than designation limits for the constituents of 8
- concern will be accepted as indicating that the piping is clean with respect to dangerous waste or 9
- dangerous waste residues. If the rinsate designates as a dangerous waste, the piping will be flushed again. 10
- If it is not possible to meet the clean closure performance standard, the particular piping of concern will 11
- be removed and disposed of accordingly. 12

#### 13 11.2.3 Closure Standards for Ancillary Equipment

- Ancillary equipment is defined as pumps and other miscellaneous equipment not otherwise specified in 14
- this closure plan. Ancillary equipment will be removed and disposed. 15

#### 11.2.4 Closure Standards for Underlying Soils 16

- The LERF retention basins have a leachate collection system for leaks or spills that channels the liquid to 17
- drains or sumps. The collected liquid is pumped back into the basins, thereby preventing spills from 18
- reaching the soil. The soil only could be contaminated if the secondary liner had failed. To determine if 19
- failure occurred, the primary liner will be inspected for leaks, holes, or punctures and the drainage gravel 20
- and bentonite carpet liner underneath the primary liner will be sampled and analyzed for contamination. 21
- If the drainage gravel analytical results determine that the constituents of concern are at or below agreed 22
- to regulatory cleanup levels (i.e., Hanford Site soil background levels (DOE-RL 1993) and/or residential 23
- exposure assumptions), the gravel will be considered clean for closure. Only if contamination is found in 24
- the drainage gravel/bentonite carpet liner will the secondary liner surfaces be inspected for leaks, holes, or 25
- punctures, which (if existing) could have provided a pathway to soil for contamination (refer to 26
- Chapter 4.0, Figure 4-3 for basin diagram). If no leaks, holes, or punctures are found in the primary liner 27
- or if the drainage gravel/bentonite carpet liner is found not to be contaminated, the soil will be considered 28
- to be clean closed. However, if leaks, holes, or punctures are found in the primary liner or the gravel is 29
- contaminated, the secondary liner surfaces will be inspected. If no leaks, holes, or punctures are found in 30
- the secondary liner surfaces, the soil will be considered clean closed. If such leaks, holes, or punctures 31
- are identified, potential soil contamination will be investigated. Soil will be sampled and analyzed for 32
- constituents of concerns. If the soil analytical results determine that, the constituents of concern are at or 33
- below agreed to regulatory cleanup levels, the soil will be considered clean closed. 34
- Clean closure of soil under the ETF will be accomplished by demonstrating that the coated concrete floor 35
- kept contaminants from reaching the soil. The coated concrete floor provided secondary containment for 36
- all the tanks and process piping. Unless inspections identify potential through-thickness cracks indicating 37
- containment failure and a subsequent potential for soil contamination from TSD unit operations, the soil 38
- will be considered clean closed. However, if inspections identify such cracks and there have been 39
- documented spills in the vicinity, potential soil contamination will be investigated. Soils will be sampled 40
- and analyzed for constituents of concern. If the soil analytical results determine that the constituents of 41
- concern are at or below agreed to regulatory clean up levels, the soil will be considered clean closed. The
- 42
- Hanford Facility RCRA Permit Condition II.K defines regulatory cleanup levels. If verification sampling 43
- is required, a sampling analysis plan will be prepared before closure in a manner consistent with Ecology 44
- guidance (Ecology 1994a) for achievement of clean closure. 45

### 11.3 CLOSURE ACTIVITIES [I-1b]

- 2 The LERF and ETF were designed for a 30-year active life. At the time of closure, the closure plan will
- 3 be modified as necessary to reflect current regulation or informational revisions. If it is determined that
- 4 clean closure is not possible, the closure plan will be modified to address required postclosure activities.

### 5 11.3.1 General Closure Activities

- 6 The approach to LERF closure is to dispose of accumulated basin aqueous waste by processing the waste
- 7 through ETF. Primary basin liners and covers will be decontaminated or disposed of as appropriate. Any
- 8 remaining solids (residue) within basins will be removed, designated, and disposed of accordingly.
- 9 Piping associated with LERF closure is intended to be decontaminated and left in place. Rinsate
- 10 generated during decontamination also will be disposed of through ETF. Sampling will assess whether
- 11 contamination beneath the primary liner has occurred. Contamination, if present, will be managed in
- 12 compliance with regulatory requirements.
- 13 The approach to ETF closure is to process any aqueous waste through the effluent treatment system. Any
- 14 containerized dangerous waste and/or mixed waste will be transferred to other TSD units. All structures
- and equipment will be decontaminated and/or disposed. Piping associated with ETF closure is intended
- 16 to be decontaminated and left in place. Contamination, if present, will be managed in compliance with
- 17 regulatory requirements.
- 18 Equipment or materials used in performing closure activities will be decontaminated or disposed at a
- 19 permitted facility.

# 20 11.3.2 Constituents of Concern for Closure for the Liquid Effluent Retention Facility and 200 Area Effluent Treatment Facility

- Using the list of dangerous waste numbers in the Part A, (Chapter 1.0) process knowledge and the risk to
- 23 human health and the environment, the constituents of concern for closure will be determined through the
- 24 data quality objective process.

### 25 11.3.3 Removing Dangerous Waste [I-1b(2)]

- At the start of LERF closure, aqueous waste will be transferred sequentially from each basin to ETF for
- 27 treatment. At a treatment rate of about 284 liters per minute, it will take approximately 60 days to empty
- 28 a full basin. Basin covers will remain in place to prevent possible wind dispersion of waste until all basin
- 29 waste has been removed.
- 30 All of the aqueous waste inventory at the ETF will be processed before closure. Any residue remaining in
- 31 piping, equipment, or the LERF liner will be removed to an appropriate disposal unit. All containerized
- 32 waste will be dispositioned. All secondary waste in containers will be transferred to an appropriate TSD
- 33 unit.

### 34 11.3.4 Decontaminating Structures, Equipment, and Soils [I-1b(3)]

- 35 This section discusses the activities necessary to implement a clean closure strategy for the LERF and
- 36 ETF. Before closure activities begin, any waste inventory stored will be removed. After the waste
- 37 inventory is removed, clean closure of the LERF covers and primary liner, drainage laver/leachate
- 38 collection system/bentonite carpet liner, secondary liner, soil bentonite, the internal piping, ancillary
- equipment, and the concrete catch basins will be accomplished by decontaminating the components as
- 40 necessary, and demonstrating that clean closure performance standards are met (Section 11.1.1). To
- 41 facilitate closure of ETF, tanks, internal piping, external piping, ancillary equipment, concrete
- 42 floors/dikes/encasements, structures, and soil directly beneath the structure will be decontaminated, as
- an ecessary, to demonstrate that the clean closure performance standards are met.

- 1 Removal and disposal of most of the components will be determined at time of closure. Clean closure of
- 2 the soil will be accomplished by demonstrating that the concrete kept contaminants from reaching the
- 3 soil.

38

### 11.3.4.1 Covers and Liners

- 5 After all pumpable waste has been removed from a given basin at LERF; the cover for that basin will be
- 6 removed. The cover either will be decontaminated or disposed of appropriately. If the cover is disposed
- of, the cover will be cut up within the basin and loaded into a lined dump truck for transport and disposal.
- 8 If the covers are to be reused, an initial decontamination effort will be made by spraying the underside of
- 9 the cover while in place over a basin. The intent of preremoval spraying is to minimize subsequent
- decontamination efforts and to use the basin as a wash water catchment. Each cover will be inspected
- visually for physical damage in the same manner as the primary liners. Visible signs of damage to the
- 12 cover will be repaired as specified by the cover manufacturer. The cover decontamination procedure will
- be to position a cover into its basin and wash the cover. Any openings, such as for vents, will be sealed
- 14 temporarily so that rinsate cannot seep through. The method and degree of washing will be the same as
- 15 necessary for the respective basin liner. The generated rinsate will be transferred from the basin to the
- 16 ETF or appropriate TSD unit.
- 17 The primary liner will be inspected visually for physical damage and surveyed before any
- decontamination efforts. Physical damage will be defined as tears, holes, or punctures such that the liner
- would not hold water. A description and location of any physical damage found will be noted in an
- 20 inspection record. Visible signs of damage to the liner will be repaired per procedures specified by the
- 21 manufacturer before decontamination to prevent liquid solutions from driving potential contamination
- down into the drainage gravel. The purpose of the inspection will be twofold: to identify and map any
- 23 physical damage in the primary liner that might have allowed contaminants a pathway to the drainage
- 24 gravel below; and to identify areas that potentially are contaminated with dangerous waste or dangerous
- waste residues. The inspection standard for the liner will be a clean debris surface as defined in
- Section 11.1.1.1. The inspection of the liner for a clean debris surface will be documented on an
- 27 inspection record. Those areas already meeting the standard can be clean closed as is, based on Ecology
- 28 acceptance of the completed record.
- 29 Those potentially contaminated areas will undergo decontamination to meet the clean closure standard of
- 30 a clean debris surface. Plastic surfaces indicated by visual examination as being potentially contaminated
- 31 will be decontaminated through use of physical extraction technologies such as high-pressure steam and
- 32 water sprays coupled with a detergent wash.
- 33 Achievement of a clean debris surface will be documented on an inspection record. Decontamination
- 34 rinsate will be transferred directly to the ETF or transferred to another basin before ultimate disposal. If it
- 35 is not possible to meet the clean closure performance standard, or there is no further need for the liner, the
- 36 primary liner could be removed, designated, and disposed of accordingly. The inspections for a clean
- 37 debris surface will be documented on an inspection record.

## 11.3.4.2 Drainage Layer/Bentonite Carpet Liner/Secondary Liner

- 39 Assessment of contamination beneath the LERF's primary liner will be performed within each basin by
- 40 sampling the drainage gravel. Biased rather than random location selection will be used to increase the
- 41 probability of detecting leachate contamination. Sampling points will be chosen where physical damage
- was noted during the inspection of the primary liner or areas where the underlying material porosity and
- permeability and the hydraulic head would most likely drive any leachate. The leakage rate through the
- liner would increase toward the bottom of the liner as hydraulic head increases. Any leakage that did
- occur in the sloped sides could be expected to travel down slope through the geotextile between the
- 46 primary and secondary liner until reaching the bottom of the liner. Therefore, the most likely area of
- 47 contamination would be the drainage gravel.

- Gravel samples will be collected by removing the bentonite carpet liner and making an incision in the
- 2 geotextile. Sampling will be performed in accordance with existing procedures at the time of sampling.
- 3 Special care will be needed in sampling for volatiles. To aid in ensuring sample integrity, the initial
- removal of gravel to create the gravel profile will not be done unless the samples can be collected 4
- 5 immediately.
- 6 Sample collection will occur immediately after profile exposure. If no constituents of concern are found
- 7 above soil closure performance standards (Section 11.1.1), no further analysis will be done. If the initial
- 8 sample analysis indicates liner leakage, analysis of the bottom sample will be performed to determine the
- 9 depth of contamination. Additional gravel samples from different locations will be taken to determine the
- 10 spatial extent of contamination.
- 11 A visual assessment of the underlying basin integrity will be made at the bottom of each sampled location
- 12 and wherever else gravel is removed. If the basin is perceived to be damaged such that leakage could
- 13 have occurred beneath the secondary liner, an amendment to the closure plan will be submitted to allow
- 14 time for additional sampling and possible gravel removal. Sampling beneath the secondary liner, if
- 15 necessary, will be attempted in accordance with sampling procedures for beneath the primary liner.
- 16 Sampling beneath the secondary liner has not been extensively addressed because of the remote
- probability of its occurrence. The drainage gravel will be the preferred flow path even if minor leaks 17
- 18 exist in the secondary liner. The secondary liner is resting on a soil/bentonite bed, which would tend to
- seal any punctures in the secondary liner as hydraulic head built up. 19
- 20 Sampling and disposal objectives will be determined at the time of closure activities through the data
- 21 quality objectives process.

#### 22 11.3.4.3 Tanks

- 23 After all pumpable waste has been removed from the tanks at ETF, the interior of the tanks, including the
- 24 internal components such as the agitator, will be washed down by adding or spraying with steam, a
- 25 water-soluble cleaner, or other approved method. The tanks will be emptied and the interiors visually
- 26 examined.
- 27 After rinsing, the tanks will be inspected visually for compliance with the performance standard. Visual
- 28 inspection might be made remotely using a camera or other device that allows verification of meeting the
- 29 standard. If any areas are found not meeting the clean debris surface performance standard, these areas
- 30 will be decontaminated in-place. Per the debris rule, only removal of contaminants from the surface layer
- 31 is necessary for metal surfaces. Contamination will be removed from the surface layer using either
- 32 high-pressure water blasting (a physical extraction method) or by hand or remote wiping, washing,
- brushing, or scrubbing using an approved cleaner, and rinsing with water or by other appropriate 33
- 34 methods.
- 35 The outside of the tanks also will be inspected for compliance to the performance standard. Any areas
- 36 found not to meet this performance standard will be decontaminated in-place. Contamination will be
- 37 removed from the surface layer using any of the methods described for internal tank decontamination or
- 38 another appropriate method. Before using decontamination solutions on the outside of the tanks, the floor
- 39 will be inspected for cracks or other openings that could provide a pathway to soil. This inspection will
- 40 be performed as described in Section 11.1.4.6 in conjunction with mapping of potential through-thickness
- cracks. Any such cracks will be mapped. The cracks will be sealed before beginning treatment or other 41
- 42
- engineered containment devices (e.g., portable catch basins, liners) will be used to collect and contain
- solutions. 43
- 44 Decontamination residues will be collected, designated, and managed as appropriate. If it is not possible
- 45 to meet the clean closure performance standard, contaminated portions of the tanks could be removed,

- designated, and disposed of accordingly. The inspections for a clean debris surface will be documented
- 2 on an inspection record.

### 3 11.3.4.4 Internal and External Piping and Ancillary Equipment

- 4 The internal piping for both LERF and ETF will be rinsed and the rinsate will be sampled and analyzed
- 5 for constituents of concern. The rinsate will be designated and disposed of appropriately. If the rinsate
- does not designate based on the concentrations of the constituents of concern, the internal piping will be
- 7 blanked to ensure that the tanks are isolated and the piping will be considered clean with respect to
- 8 RCRA. If the rinsate designates as a dangerous waste, the piping will be flushed again. If necessary, the
- 9 piping will be rinsed with a decontamination solution before sampling and analyses. If it is not possible
- to meet the clean closure standard, portions of the internal piping will be removed, designated, and
- disposed of accordingly. The ancillary equipment will be removed, designated, and disposed of
- 12 accordingly.
- 13 External piping (transfer lines) between the 242-A Evaporator and LERF and between LERF and ETF
- will be flushed and the rinsate analyzed for constituents of concern. If the rinsate designates as a
- dangerous waste, the piping will be flushed again. If necessary, the piping will be rinsed with a
- decontamination solution before sampling and analyses. If it is not possible to meet the clean closure
- standard, the piping will be removed and disposed of accordingly. If the rinsate does not designate, the
- piping will be considered clean and will remain in place.
- 19 If the rinsate designates as dangerous waste, rinsate from the external piping and LERF internal piping
- 20 will be processed through ETF. Rinsate from ETF will be transferred to another TSD unit.

### 21 11.3.4.5 Concrete

- 22 At LERF, the concrete catch basins are located at the northeast corner of each retention basin, where inlet
- 23 pipes, leachate risers, and transfer pipe risers emerge for the basin. The concrete catch basin is curbed,
- 24 and coated with a chemical resistant epoxy sealant. The concrete catch basin is sloped so that any leaks
- or spills from the piping or connections will drain into the basin. At the ETF, the coated concrete floor
- and berm provides secondary containment for all the tanks and process piping.
- 27 At LERF and ETF, all concrete will be inspected visually and surveyed before any decontamination. The
- 28 purpose of the inspection will be twofold: to identify and map any cracks in the concrete that might have
- allowed contaminants a pathway to the soil below (Section 11.1.2.3.), and to identify areas that
- 30 potentially are contaminated with dangerous waste or dangerous waste residues. The inspection standard
- will be a clean debris surface as defined in Section 11.1.1. The inspection of the concrete for a clean
- 32 debris surface will be documented on an inspection record. Those areas already meeting the standard can
- 33 be clean closed as is.
- 34 Those potentially contaminated areas will undergo decontamination to meet the clean closure standard of
- 35 a clean debris surface. The concrete will be washed down, the rinsate collected, designated, and disposed
- 36 of accordingly. The concrete will be reinspected for a clean debris surface. Concrete surfaces indicated
- 37 by visual examination, as still being potentially contaminated will have the surface layer removed to a
- depth of 0.6 centimeter by scabbling or other approved methods. This will not threaten the environment,
- 39 even if potential through-thickness cracks had been found during the inspection, because concrete
- decontamination (scabbling) will not employ liquid solutions that could enter cracks and because
- 41 scabbling residues will be vacuumed away from cracks as any residue is generated.
- 42 Achievement of a clean debris surface will be documented on an inspection record. Decontamination
- 43 residues will be collected, designated, and managed as appropriate.

### 11.3.4.6 Structures

6

- 2 If contaminated with either dangerous or mixed waste constituents, the ETF structures will be
- 3 decontaminated and/or disassembled, if necessary, packaged, and disposed of in accordance with existing
- 4 land disposal restrictions (WAC 173-303-140).
- 5 Closure steps could include the following activities.
  - Containerize (as necessary and practicable) and remove any remaining waste.
- Review operating records for spillage incidents and visually inspect storage area surfaces for evidence
   of contamination or for cracks that could harbor contamination or allow the escape of
- 9 decontamination solutions. Inspect storage area surfaces for visible evidence of contamination
- 10 (e.g., discoloration, material degradation, wetness, and odor). If contamination is evident, the
- affected area(s) will be decontaminated.
- 12 Decontaminate ETF walls and floors to minimize the potential for loose contamination and facilitate
- any required surveys and/or chemical field screening. The structures could be cleaned by water rinse
- or high-pressure, low-volume steam cleaning coupled with a detergent wash. After decontamination,
- the walls and floors will be compared to closure performance standards.
- Collect rinsate and manage as dangerous waste for appropriate disposal.
- Secure (lock) personnel entries into building and post doors with appropriate warning signs.
- 18 Clean closure of structures will occur in accordance with WAC 173-303-610. Remediation of soil
- 19 contamination beneath or around containment buildings will be performed in conjunction with soil
- 20 closure requirements.

### 21 11.3.4.7 Underlying Soils

- 22 Clean closure of soil under LERF's secondary liner will be accomplished by demonstrating that the liners
- 23 and leak detection system kept contaminants from reaching the soil. The secondary liner provided
- 24 secondary containment for the LERF basins. Unless inspections identify potential leaks, punctures,
- cracks, or tears indicating containment failure and a subsequent potential for soil contamination from
- TSD unit operations, the soil will be considered clean closed. However, if inspections identify such
- leaks, punctures, etc., potential soil contamination will be investigated.
- 28 Clean closure of soil under ETF will be accomplished by demonstrating that the coated concrete floor
- 29 kept contaminants from reaching the soil. The coated concrete floor and bermed area provided secondary
- 30 containment for all the tanks and process piping. Unless inspections identify potential through-thickness
- 31 cracks indicating containment failure and a subsequent potential for soil contamination from TSD unit
- 32 operations, the soil will be considered clean closed. However, if inspections identify such cracks and
- there have been documented spills in the vicinity, potential soil contamination will be investigated.
- Where it is possible visually to inspect directly beneath the tanks, a visual inspection will be performed.
- Where it is not possible visually to inspect beneath the tanks, an evaluation of the tank integrity will be
- made. The condition of the tank will be evaluated to determine if there was any potential for leakage. If
- 37 no cracks, severe corrosion, or evidence of leaks is observed, it will be reasoned that mixed or dangerous
- waste solutions could not have penetrated to the soil directly below the tank.
- 39 External piping (transfer lines) between the 242-A Evaporator and LERF and ETF are
- double-lined with a leak detection system. If records indicate that no leaks from the primary piping
- occurred, the soil will be considered clean with respect to RCRA closure.

### 1 11.4 MAXIMUM WASTE INVENTORY [I-1c]

2 The maximum waste inventory for ETF/LERF is found in Attachment 34, Chapter 1.0.

# 3 11.5 CLOSURE OF CONTAINERS, TANKS, AND SURFACE IMPOUNDMENTS [I-1d]

- 4 The following sections cover closure of containers, closure of tanks, and closure of surface
- 5 impoundments.

### 6 11.5.1 Closure of Containers [I-1d(1)]

- 7 Containers at ETF will be used to contain dangerous waste in the event of a spill, unexpected release, or
- 8 equipment failure. Containers will be used to accumulate nonradioactive dangerous waste and/or mixed
- 9 waste. Any containers used to contain dangerous and/or mixed waste at the ETF will be disposed of in
- the appropriate manner. Containers of dangerous and/or mixed waste will not be left in the ETF after
- 11 closure.

### 12 11.5.2 Closure of Tanks [I-1d(2)]

- 13 Clean closure of ETF will consist of the removal and disposal of all dangerous waste and the
- decontamination and/or removal and disposal of contaminated equipment, including tanks. The ETF was
- 15 designed to incorporate removable components. This design facilitates closure by allowing complete
- 16 removal of equipment contaminated with dangerous and mixed waste.

## 17 11.5.3 Closure of Surface Impoundments [I-1d(4)]

- 18 At closure, all of LERF that received regulated waste will be closed in accordance with the requirements
- of WAC 173-303-650(6)(a)(i). All equipment, structures, and other material associated with closure of
- 20 LERF will be decontaminated or removed in accordance with WAC 173-303-610(2). All basin waste and
- 21 decontamination rinsate will be transferred to ETF. Sampling and testing will be conducted.

### 22 11.6 SCHEDULE FOR CLOSURE [I-1f]

- 23 Closure of LERF and ETF is not anticipated to occur within the next 30 years. The actual year of closure
- 24 will depend on the time required for current waste to be processed and what role the LERF and ETF will
- 25 play in processing additional waste generated during future activities in the 200 Areas. Other factors
- affecting the year of closure include changes in operational requirements, lifetime extension upgrades,
- and unforseen factors. When a definite closure date is established, a revised closure plan will be
- 28 submitted to Ecology.
- 29 The activities required to complete closure are planned to be accomplished within 180 days. Should a
- 30 modified schedule be necessary, a revised schedule will be presented and agreed to before closure.

1 .	Conte	ents	
2	12.0	REPORTING AND RECORDKEEPING	Att 34.12.

### 12.0 REPORTING AND RECORDKEEPING

- 2 Reporting and recordkeeping requirements that could be applicable to the Hanford Facility are described
- 3 in Attachment 33, Chapter 12.0 (DOE/RL-91-28). Not all of these requirements and associated reports
- 4 and records identified in Attachment 33, Chapter 12.0 are applicable to the LERF and the ETF. Those
- 5 reporting and recordkeeping requirements determined to be applicable to the LERF and the ETF are
- 6 summarized as follows:
- Hanford Facility Contingency Plan and incident records (as identified in the General Information
   Portion):
- 9 Immediate reporting
- 10 Written reporting
- 11 Shipping paper discrepancy reports.
- Unit-specific permit documentation and associated plans
- Personnel training records
- Groundwater monitoring records
- Inspection records (unit)
- Onsite transportation documentation
- Land disposal restriction records
- Waste minimization and pollution prevention.
- 19 In addition, the following reports prepared for the Hanford Facility will contain input, when appropriate,
- 20 from the LERF and the ETF:
- 21 Quarterly Hanford Facility RCRA Permit modification report
- Anticipated noncompliance
- 23 Required annual reports.
- 24 Annual reports updating projections of anticipated costs for closure and postclosure will be submitted
- 25 when the LERF and the ETF closure plan is submitted to Ecology (Attachment 34, Chapter 11.0).
- 26 The LERF and the ETF Operating Record 'records contact' is kept on file in the General Information file
- of the Hanford Facility Operating Record (refer to Attachment 33, Chapter 12.0, DOE/RL-91-28).

1	Conte	ents	 
2	13.0	OTHER FEDERAL AND STATE LAWS [J]	 Att 34.13.1

### 13.0 OTHER FEDERAL AND STATE LAWS [J]

- 2 Applicable federal, state, and local laws applicable to the LERF and the ETF are discussed in
- 3 Attachment 33, Chapter 13.0 (DOE/RL-91-28). Generally, the laws applicable to the LERF and the ETF
- 4 include, but might not be limited to, the following:
- 5 Atomic Energy Act of 1954
- 6 Federal Facility Compliance Act of 1992
- 7 Clean Air Act of 1977
- 8 Safe Drinking Water Act of 1974
- 9 Emergency Planning and Community Right-to-Know Act of 1986
- 10 Toxic Substances Control Act of 1976
- 11 National Historic Preservation Act of 1966
- 12 Endangered Species Act of 1973
- 13 Fish and Wildlife Coordination Act of 1934
- 14 Federal Insecticide, Fungicide, and Rodenticide Act of 1975
- 15 Hazardous Materials Transportation Act of 1975
- 16 National Environmental Policy Act of 1969
- Washington Clean Air Act of 1967
- 18 Washington Water Pollution Control Act of 1945
- 19 Washington Pesticide Control Act of 1971
- 20 New Source Construction Permits
- 21 Model Toxics Control Act
- 22 Benton Clean Air Authority Regulation 1
- 23 State Environmental Policy Act of 1971.

24

# ATTACHMENT 35 242-A Evaporator

3	Cont	ents	
4	1.0	Part A Dangerous Waste Permit	·
5	2.0	Unit Description	Attachment 35.2.i
6	3.0	Waste Analysis Plan	Attachment 35.3.i
7	4.0	Process Information	Attachment 35.4.i
8	6.0	Procedures to Prevent Hazards	Attachment 35.6.i
9	7.0	Contingency Plan	Attachment 35.7.i
10	8.0	Personnel Training	Attachment 35.8.i
11	11.0	Closure and Financial Assurance	Attachment 35.10.i
12	12.0	Reporting and Recordkeeping	Attachment 35.12.i
13	13.0	Other Relevant Laws	Attachment 35.13.i
14	App	endix	
15	4B	242-A Evaporator/Crystallizer Tank System Integrity Assessment Report.	Attachment 35.4B.i

[ .	Co	nte	nts

1.0 PART A [A]

- 2 The following is a chronology of the regulatory history of the 242-A Evaporator.
- On September 1, 1987 the original Hanford Facility Dangerous Waste Part A Permit Application (Part A), Form 3, Revision 0 was submitted to the Washington State Department of Ecology (Ecology).
- On November 16, 1987, the Part A, Form 3, Revision 1, added Westinghouse Hanford Company
   (WHC) as co-operator.
- on February 26, 1990 the Part A, Form 3, Revision 2, added new dangerous waste numbers to reflect the waste identified within the Double-Shell Tank (DST) System (DOE/RL-90-39) and provided additional information on the process condensate waste stream.
- On December 20, 1990, the Part A, Form 3, Revision 3, added applicable dangerous waste numbers resulting from the addition of 15 new dangerous waste numbers subject to toxicity characteristics leaching procedure testing. Also, the Part A, Form 3, added nonspecific source Dangerous Waste Number F005.
- On April 13, 1993, the Part A, Form 3, Revision 4, added nonspecific source Dangerous Waste
   Numbers F001, F002, and F003 to corresponded with the dangerous waste numbers from the DST
   System.
- On November 4, 1994, the Part A, Form 3, Revision 5, added Dangerous Waste Number F039 (multisource leachate). Dangerous Waste Number F039 was added to reflect Low-Level Burial Grounds (DOE/RL-88-20) generation of multi-source leachate from lined mixed waste trenches.
- On January 1, 1995, the Part A, Form 3, Revision 6, added Process Code S02 and increased the process design capacity for tank storage for tanks C-100 and C-A-1 and converted English measurements to metric.
- On October 10, 1997, the Part A, Form 3, Revision 7, was revised to support the transition of this treatment, storage, and/or disposal unit (TSD) to the new Project Hanford Management Contractor.
  Also, the Part A, Form 3 was submitted to streamline the dangerous waste numbers list.
- On May 26, 2003, the Part A Form 3, Revision 8, was revised to support the transition of this treatment, storage, and/or disposal unit (TSD) to the Tank Farm Contractor.
- On December 31, 2003 the Part A Form 3 Revision 8A was revised to remove the ion-exhange column and add the process condensate line (PC 5000).

Attachment 35.1.ii

FORM 3	<del>- Y</del>			T TID A COLLEGE TO DEL
FURIN 3	DANGEROUS V	VASTE PERMIT AP	PLICATION	I. EPA/State I.D. No.
***				W A 7   8   9   0   0   0   8   9   6
	AL USE ONLY			
Application	Date Received		Comments	
Approved	(month/ day / year)		Comments	
		<u> </u>		
II. EIRST OR	REVISED APPLICATION			
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	lication, enter your facility's EPA/			ty SEFABIATE L.D. Number, of it this is
A. First Ap	plication (place an "X" below and	provide the appropriate da	re)	
1.	Existing Facility (See instruction	s for	2 Now English (	Complete item below.)
	definition of "existing" facility. C	omplete item below.)	2. New Facinity (	complete tem below.
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		the date construction commen		began or is expected to beg
		(use the boxes to the	,	
		f the Hanford Facility commer		
B. Revised	Application (Place an "X" below	and complete Section I abo		•
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TH. DD 0 000	TEG CONTO INT PROJECT C	· ·	<del></del>	
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1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			. =	to a Depth of one foot) or hectare-meter
Land applic	ation .		. D82	Acres or hectares
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Surface im	ooundment		T02	Gallons per day or liters per day
Incinerator			T03	Tons per hour or metric tons per hour, gallons
				per frour or liters per hour
Other (use	for physical, chemical, thermal or biole	ogical treatment	T04	Gallons per day or liters per day
	of occurring in tanks, surface impound		•••	
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ECY 030-31 Form 3 (Rev. 7/97)
\*Add per request of Washington State Department of Ecology (01/2001)

### III. PROCESS - CODES AND DESIGN CAPACITIES (continued)

Example for Completing Section III (shown in line numbers X-1 and X-2 below): A facility has two storage tanks; one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

Line	A. Process Code (from list above)			B. Process Design Capacity									
No.				1. Amount (Specify)		2. Unit of Measure (enter code)			For Official Use Only				
X-1	S	0	2		600		A 121 17 170	''G	THE CL				di di
X-2	T	0	3		20		(B) (1 m. 1822) Romanno, (1 m. 1822)	E	d Laboration				
1.	Т	0 .	4		870,642		· ·	V					
2	S	0	2	:	170,597			L					
3					* .								
4				·									
5					-								
6				110									<u> </u>
7													
8							1						
9													
10											1		1

C. Space for additional process codes or for describing other process (code "T04"). For each process entered here include design capacity.

### T04

The 242-A Evaporator began waste management operations in March of 1977. The 242-A Evaporator is located in the 200 East Area and is used to treat mixed waste from the Double-Shell Tank (DST) System by removing water and most volatile organics. Two waste streams leave the 242-A Evaporator following the treatment process. The first stream, the concentrated slurry (approximately 40 to 60 percent of the water is removed during evaporation along with a portion of volatile organics), is pumped back into the DST System. The second waste stream, process condensate (containing a portion of the volatile organics removed from the mixed waste during the evaporation process), is routed through condensate filters before release to a retention basis (Liquid Effluent Retention Facility). Offgasses from the process are routed through a de-entrainment unit, a prefilter, and high-efficiency particulate air filters before being discharged to the environment. The 242-A Evaporator is used to treat up to 870,642 liters (230,000 gallons) of mixed waste per day.

### S02

Tank C-100, a 4.3-meter (14-foot) diameter and 5.9-meter (19-foot) high tank with a maximum design capacity of 67,380 liters (17,800 gallons) is located in the condensate room. Process condensate from the primary, inter-, and after-condensers drain by gravity to tank C -100, which is constructed of stainless steel. In addition, tank C-100 receives potentially contaminated drainage from the vessel vent system via a 102 -liter (27 gallon) seal pot.

Tank C-A-1 is located in the evaporator room and consists of two sections: the lower (liquid) section, a 4.3-meter (14-foot) diameter stainless steel shell, and an upper (vapor) section, a 3.5-meter (11.6-foot) diameter stainless steel shell, containing two wire-mesh de-entrainment pads for the removal of liquids and solids that could be carried into the vapor header. Process slurry from the reboiler discharges to the evaporator vessel (tank C-A-1). Concentrated process slurry exits the lower section of tank C-A-1 via the 28-inch recirculating line. Vapor flows out of tank C-A-1 through a 42-inch vapor line at the top. The maximum design capacity of tank C-A-1 is 103,217 liters (27,267 gallons).

### IV. DESCRIPTION OF DANGEROUS WASTES

Dangerous Waste Number — Enter the digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four-digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.

- B. Estimated Annual Quantity For each listed waste entered in column A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A, estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.
- C. Unit of Measure For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate odes are:

		The state of the s	经保证条款 二胚 经	THE THE BEAUTIFUL DESIGNATION OF THE PARTY O		The second second second second	CODE
THE RESERVE OF THE PARTY OF THE	COLUMN TENET		CODE	METRIC LINIT	OF MEASURE	the state of the s	CUDE
ENGLISH UNIT OF M	LASUKE		CODE	19112/11/10/01/414	01 1.1212002		
	Bullia in the contract of the		will till a silverier	And a blank but the start of a	أما بالمراجراني بوالمؤثر الدار الدي	ay a signer en seedit is	그 본 경영 근 등이 되는 고양하기 하는 사
				partition and the second	and the state of t		12
	翼 상황하다 하는 다.	いっとうしゅう 一部 静能力	P	Kilograms	N 10 1	The second second second	32N.
Pounds	#Historian are			TELEVERIE	1.00	Appendix of the second	- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1
	[환경하다중앙 다 우리 날리기기의		न	Metric Tons	27	The state of the s	<b>2V1</b>
Tons	銀金の経済 しゅうしきょう		1	WIGHT TORS	and the state of t	医表面 医二角	
	#FFF7間引作を20mmに対抗を	The latest the Miller and the series	1981 AND AND A 12 P.	Saffer Sagar Country Special parties of the	[4] A. Martin, and Statistical Law of State (Page 1987).	military and resident and the are in-	and lead to differ a relief of

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

### D. Processes

### 1. Process Codes:

For listed dangerous waste: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained in Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. Process Description: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER - Dangerous wastes that can be described by more than one Waste Number shall be described on the form as follows:

- I. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
- 2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "Included with above" and make no other entries on that line.
- 3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

Example for completing Section IV (shown in line numbers X-1, X-2, X-3, and X-4 below) - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste.

Line	A. Dangerous Waste No.	B. Estimated Amual	C. Unit of Measure	D. Processes			
No.	(enter code)	Quantity of Waste	(enter code)	1. Process Codes (enter)	2. Process Description (if a code is not entered in D(1))		
X-1	x 0 1 5 1 4	900	· P	T03 D80			
X-2	$D = \theta^{-1} - \theta^{-1} - 2$	400	P	T03 D80			
X-3	D 0 0 7	100	P	T03 D80			
Y-4	D 0 0 2			T03 D80	Included with above		

Quarter Ending 12/31/2003

Photocopy this page before completing if you have more than 26 wastes to list.

I.D. Number (enter from page 1)

W | A | 7 | 8 | 9 | 0 | 0 | 0 | 8 | 9 | 6 | 7

IV. I	ESCE	RIPTIC	ON OF	DANC	GEROUS WASTES (continue	d)							
Line	ine A. Dangerous Waste No. B. Estimated Annua		B. Estimated Annual	C. Unit of Measure		D. Processes							
No.	71. 15		code)		Quantity of Waste	(enter code)		1. Process Codes (enter)		es	2. Process Description (if a code is not entered in D(1))		
1	D	0	0	1	635,029,318		К		T04				Treatment - Evaporation
2	D	0	0	2			K	1 4 3 2 2 1	T04				Treatment - Evaporation
_ 3	D	0	0	3			К		T04				Treatment - Evaporation
4	D	0	0	4			К		T04				Treatment - Evaporation
5	D	0	0	5			K		T04				Treatment - Evaporation
6	D	. 0	0	6			K		T04				Treatment - Evaporation
7	D	0	0	7			К		T04		1		Treatment - Evaporation
8	D	0	0	8			К		T04				Treatment - Evaporation
9	D	0	0	9			K		T04			<u> </u>	Treatment - Evaporation
10	D	0	1	0		1	K		T04				Treatment - Evaporation
11	D	0	1	1			К		T04			1	Treatment - Evaporation
12	D	0	1	8		1	К		T04	<del></del>		<b>†</b>	Treatment - Evaporation
13	D	0	1	9		1	K		T04			1	Treatment - Evaporation
14	D	0	2	2		<del> </del>	K		T04		<del>                                     </del>		Treatment - Evaporation
15	D	0	2	8		<del>                                     </del>	K		T04	<del></del>	<del> </del>	1 1	Treatment - Evaporation
16	D	0	2	9		-	K		T04	·····			<del></del>
17	D	0	3	0		1	K		T04		1		Treatment - Evaporation
	D	0	3	3			ļ					-	Treatment - Evaporation
18		ļ <u>-</u>	<del> </del>	4		ļ	K		T04	·	ļ	-	Treatment - Evaporation
19	D	0	3	ļ			K		T04	· · · · ·	<del> </del>		Treatment - Evaporation
20	D	0	3	5		<u> </u>	K		T04		<u> </u>	-	Treatment - Evaporation
21	D	0	3	6			-K		T04			1	Treatment - Evaporation
22	D	0	3	8		ļ	K		T04		ļ		Treatment - Evaporation
23	D.	0	3	9			K		T04	<del>,</del>			Treatment - Evaporation
24	D	0	4	0		ļ	K		T04				Treatment - Evaporation
25	D	0	4	1			K		T04	· · · · · · · · · · · · · · · · · · ·			Treatment - Evaporation
26	D	0	4	3		-	K		T04			1	Treatment - Evaporation
27	W	T.	0	1			K		T04				Treatment - Evaporation
28	W	T.	0	2			K		T04				Treatment - Evaporation
29	W	P	0	1			К		T04				Treatment - Evaporation
30	W	P	0	2			K		T04				Treatment - Evaporation
31	F	0	0	1			K		T04				Treatment - Evaporation
32	F	0	0	2			К		T04				Treatment - Evaporation
33	F	0	0	3			K		T04				Treatment - Evaporation
34	F	0	0	4			K		T04				Treatment - Evaporation
35	F	0	0	5			К		T04				Treatment - Evaporation
36	F	0	3	9			K		T04				Treatment – Evaporation
37	D	0	0	1	170,597		K		S02				Storage-Tank
38	D	0	0	2			K		S02				Storage-Tank
39	D	0	0	3			K		S02				Storage-Tank
40	D	0	0	4			K		S02			1	Storage-Tank
41	D	0	0	5			К		S02	·	<u> </u>		Storage-Tank
42	D	0	0	6			K		S02		1	1	Storage-Tank
43	D	0	0	7			К		S02		-		Storage-Tank
	030-31	Form 3	Rev 7	797)		·		1			<del></del>	<del>-1</del>	

Class 1 Modification

Quarter Ending 12/31/2003

Photocopy this page before completing if you have more than 26 wastes to list.

I.D. Number (enter from page 1)

A 7 8 9 0 0 0 8 9 6 7

					D.		D.	Processes				
Line No.	A. Da	ngerous (enter (	s Waste code)	No.	B. Estimated Annual Quantity of Waste		C. Unit of Measure (enter code)					2. Process Description (if a code is not entered in D(1))
44	D	0	0	8			K	S02			Storage-Tank	
45	D	0	0	9		1	К	S02			Storage-Tank	
46	D	0	1	0			К	S02			Storage-Tank	
47	D	0	1	1			К	S02			Storage-Tank	
48	D	0	1	8			К	S02			Storage-Tank	
49	D	0	1	9			К	S02			Storage-Tank	
50	D	0	2	2:			К	S02			Storage-Tank	
51	D	0	2	8			К	S02			Storage-Tank	
52	D	0	2	9			K	S02			Storage-Tank	
53	D	0	3	0			К	S02			Storage-Tank	
53 54	ļ	0	3	3			K	S02			Storage-Tank	
	<del>                                     </del>	0	3	4			К	S02			Storage-Tank	
55 56	1	0	3	5			К	S02			Storage-Tank	
		0	3	6			К	S02			Storage-Tank	
57	<del></del>	0	3	8			К	S02			Storage-Tank	
58	<del>-</del>	0	3	9			К	S02			Storage-Tank	
<u>~ 59</u>		0	4	0			K	S02			Storage-Tank	
60	+	0	4	1.			К	S02			Storage-Tank	
61		0	4	3			К	S02			Storage-Tank	
62		T	0	1			K	S02			Storage-Tank	
63		<u>'</u>	0	2			К	S02			Storage-Tank	
64		P	0	1			K	S02			Storage-Tank	
65	<del></del>	P	0	2			K	S02			Storage-Tank	
66		0	0	1			К	S02			Storage-Tank	
67	<del></del>	0	0	2			К	S02			Storage-Tank	
- 68	<del></del>	0	0	3		<del></del>	К	S02			Storage-Tank	
69			0	4			K	S02	<del> </del>		Storage-Tank	
70		0	+	5		-	K	S02			Storage-Tank	
7		10	3	9			K	S02			Storage-Tank	
7:		10	·	9				S02	<del>                                     </del>	<del>                                     </del>	Storage-Tank	
7:	<del></del>	+	-				<del>                                     </del>	S02	<del>                                     </del>		Storage Tank	
7.						.	<del>                                     </del>	\$02		1	Storage Tank	
7	6	<del></del>	-	-		_	+	\$02	1552	+	Storage-Tank	

#### IV. DESCRIPTION OF DANGEROUS WASTE (continued)

E. Use this space to list additional process codes from Section D(1) on page 3.

The 242-A Evaporator is used to treat and store mixed waste from the DST System. Two waste streams leave the 242-A Evaporator following the treatment process; a concentrated slurry waste stream that is routed to the DST System and a process condensate waste stream that is routed to the Liquid Effluent Retention Facility.

The waste fed to the 242-A Evaporator is regulated as a mixed waste with the same waste constituents as the waste in the DST System. The concentrated slurry is a characteristic waste (D001, D002, and D003), toxic waste (D004 through D011, D018, D019, D022, D028 through D030, D033 through D036, D038 through D041, and D043), nonspecific source waste (F001 through F005 and F039), and state-only characteristic waste (WT01, WT02, WP01, WP02. Multi-source leachate (F039) is included as a waste derived from nonspecific source waste F001 through F005.

The process condensate is regulated as a mixed waste due to the toxicity of ammonia (WT02) and because it is derived from the waste with a nonspecific source wastes F001 through F005. Multi-source leachate (F039) is included as a waste derived from nonspecific source waste F001 through F005.

The list of dangerous waste constituents under Section IV.A includes constituents that have not been detected in the waste; however, knowledge of the processes providing the waste to the 242-A Evaporator indicates the strong possibility that these constituents are present in the waste or there is a potential for treating these constituents in the future. The annual waste quantity listed under Section IV.B was calculated using an operating schedule of 365 days per year and a specific gravity of 2.0 for the waste. This calculation was done to provide a <u>maximum</u> estimate of annual waste quantity.

ino make make make a grant to provide a g	Meximum Courties of artificial	waste quartity.	
V. FACILITY DRAWING Refer to attached drawing(s).		<del></del>	
All existing facilities must include in the space provided of	on page 5 a scale drawing of the	facility (see instru	ctions for more detail).
VI. PHOTOGRAPHS Refer to attached photograph(s).			
All existing facilities must include photographs (aerial or and disposal areas; and sites of future storage, treatment or	ground-level) that clearly deline or disposal areas (see instruction	ate all existing strusting strusting structure.	uctures; existing storage, treatment
VII. FACILITY GEOGRAPHIC LOCATION	This information is provide	ded on the attached	drawings and photos.
LATITUDE (degrees, minutes, & seconds)	LO	NGITUDE (degree	es, minutes, & seconds)
VIII. FACILITY OWNER			Marie Company of the
<ul> <li>A. If the facility owner is also the facility operator as list left and skip to Section IX below.</li> <li>B. If the facility owner is not the facility operator as liste</li> </ul>		•	
Name of Facility's Leg	gal Owner	2	2. Phone Number (area code & no.)
3. Street or P.O. Box	4. City or Town	5. St.	6. Zip Code
IX. OWNER-CERTIFICATION		, i	•
I certify under penalty of law that I have personally examined and am on my inquiry of those individuals immediately responsible for obtain I am aware that there are significant penalties for submitting false by	ing the information, I believe that the	e submitted informati	ion is true, accurate, and complete. ent.
Name (print or type) Signature	r. C1.		Date Signed
Keith A. Klein, Manager U. S. Department of Energy	· Lattell	$Q_{ij}$	5/15/03
Name (print or type) Signature			Date Signed
Roy J. Schepens, Manager U. S. Department of Energy	J. Scheren		5/15/03
X. OPERATOR CERTIFICATION	FJ		
I certify under penalty of law that I have personally examined and am on my inquiry of those individuals immediately responsible for obtain. I am aware that there are significant penalties for submitting false inf	ing the information, I believe that the	e zubmisted informati	ion is true, accusate, and complete.
Name (Print Or Type) See attachment			Date Signed

#### X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the Information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Keith A. Klein, Manager U.S. Department of Energy

Richland Operations Office

Roy J. Shepens, Manager

U.S. Department of Energy Office of River Protection

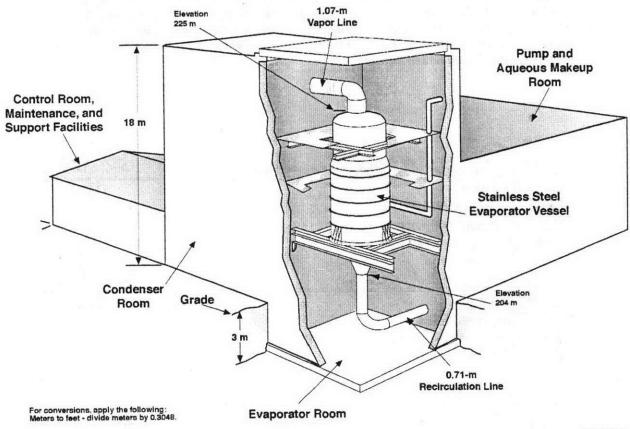
Co-Operator

Edward S. Aromi Jr.

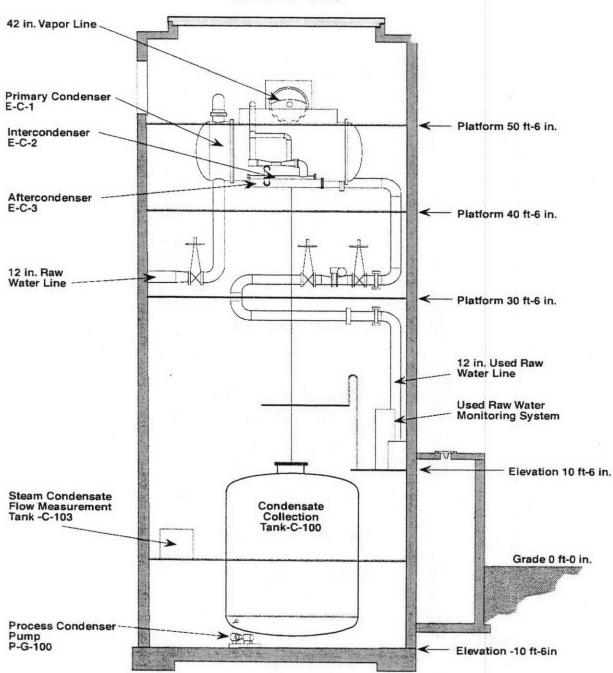
President and General Manager CH2M HILL Hanford Group, Inc.

Date

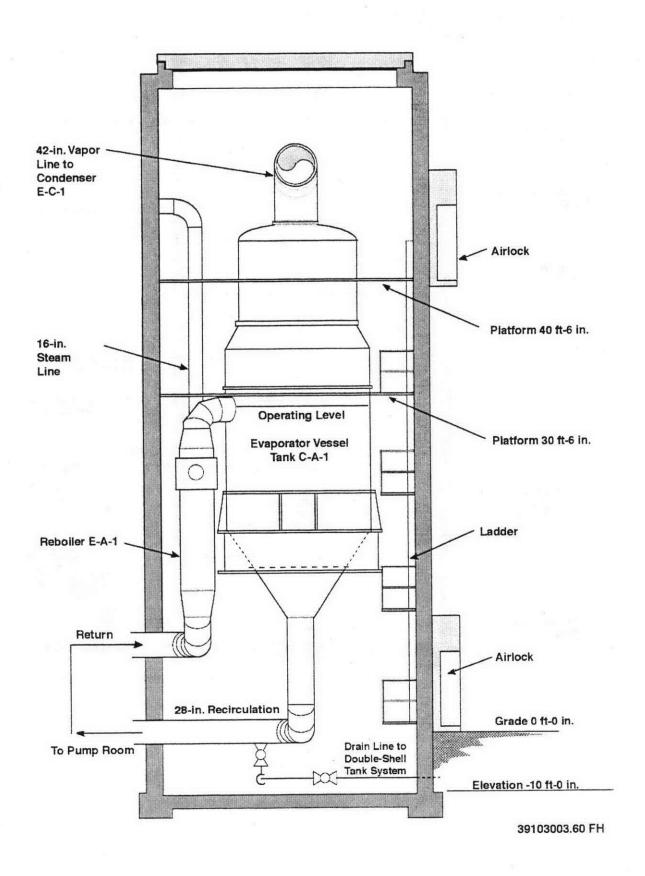
# 242-A Evaporator



# Tank C-100



Tank C-A-1



# 1 Contents

	·		•
2	2.0	UNIT DESCRIPTION	Att 35.2.1
3			
1	2.1	TOPOGRAPHIC MAP	A# 35 2 1
Ŧ	∸.1	TOLOGICALIEC MAL	

2 3 4

5

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#### 2.0 UNIT DESCRIPTION

- 2 The 242-A Evaporator unit description and general provisions were provided in the Part B permit
- 3 application, Chapter 2.0 (DOE/RL-90-42, Rev 0). Washington Administrative Code (WAC) 173-303 was
- 4 used to prepare the Part B permit application and does not require this information to be included in the
- 5 unit-specific operating Permit. The exception to this is the topographic map (refer to Section 2.1).
- 6 DOE/RL-90-42, Chapter 2.0 was used for the sole purpose of permitting the 242-A Evaporator and as
- 7 such has not been updated since the time of permit issuance. A brief unit description is provided in
- 8 Attachment 35, Chapter 1.0 and further detail is provided in Attachment 35, Chapter 4.0, Process
- 9 Description of this Permit. Seismic consideration information is provided in Attachment 33,
- 10 Chapter 2.0, §2.3 (DOE/RL-91-28, General Information Portion). Traffic information is provided in
- 11 Attachment 33, Chapter 2.0, §2.4 (DOE/RL-91-28, General Information Portion).

#### 2.1 TOPOGRAPHIC MAP

- 13 Topographic map Drawing H-13-000039, Rev 2, 200 Area Liquid Waste Processing Facilities,
- 14 242-A Evaporator, Liquid Effluent Retention Facility, Effluent Treatment Facility, Sheet 1 of 2, and
- 15 Sheet 2 of 2.

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48

3.10

#### Contents WASTE ANALYSIS PLAN......Att 35.3.1 2 3.0 3 INTRODUCTION Att 35.3.1 4 3.1 5 PURPOSE Att 35.3.1 6 3.2 SCOPE......Att 35.3.1 8 3.3 9 10 3.4 11 WASTE IDENTIFICATION .......Att 35.3.2 12 3.5 General Constituent Description.......Att 35.3.2 13 3.5.1 14 3.5.2 3.5.3 15 16 WASTE ACCEPTANCE PROCESS .......Att 35.3.4 17 3.6 Candidate Feed Waste Acceptance Process.......Att 35.3.4 18 3.6.1 Selecting Candidate Feed Tanks.......Att 35.3.5 19 3.6.1.1 Determining the Number of Candidate Feed Tank Samples ......Att 35.3.5 20 3.6.1.2 3.6.1.3 21 22 3.6.2 23 Determining the Number of Process Condensate Samples......Att 35.3.6 3.6.2.1 24 3.6.2.2 25 242-A EVAPORATOR ACCEPTANCE CRITERIA ......Att 35.3.6 3.7 26 Candidate Feed Tank Waste Acceptance Criteria.......Att 35.3.9 27 3.7.1 Exothermic Reactions Att 35.3.9 28 3.7.1.1 Compatibility .......Att 35.3.9 29 3.7.1.2 30 3.7.1.3 31 3.7.2 32 33 3.8 Sample Collection Att 35.3.12 34 3.8.1 35 3.8.1.1 Candidate Feed Tank Sampling Quality Assurance and Quality Control .......Att 35.3.12 3.8.1.2 36 3.8.1.3 37 38 3.8.1.4 39 3.8.2 40 ANALYTICAL METHODS AND QUALITY ASSURANCE AND 41 3.9 42 43 3.9.1 44 3.9.2 Laboratory Quality Assurance and Quality Control.......Att 35.3.14 45 3.9.3 46

REFERENCES Att 35.3.17

1	Figures			
2 3 4	Figure 3.2.	242-A Evaporator Simplified Schematic	At	
5	Tables			
6	Table 3.1.	Waste Designation for Process Condensate.	At	t 35.3.4
7		Candidate Feed Tank Limits for Vessel Vent Organic Discharge		35.3.10
8		Candidate Feed Tank Limits for LERF Liner Compatibility f		35.3.11
9		Candidate Feed Tank Sample Point Selection		35.3.13
10		Analytes for Candidate Feed Tanks.		35.3.14
1		Analytical Methods for Candidate Feed Tank Stream Analytes	Att	35.3.15
2		Quality Assurance Requirements for Candidate Feed Tank Stream Analy		35.3.16

# **GLOSSARY**

2	ASTM		American Society for Testing and Materials
3	AWWA		American Water Works Association
4 5	CFR		Code of Federal Regulations
6	$C_{\mathrm{T}}$		total carbon
7	O <sub>1</sub>		
8	DOE		U. S. Department of Energy
9	DQO		data quality objective
10	DQO/DEFT		data quality objective/decision error feasibility trials
11	DSC		differential scanning calorimeter
12	DST	•	Double-Shell Tanks
13		* .	
14	Ecology		Washington State Department of Ecology
,15	EPA		U.S. Environmental Protection Agency
16	ETF		200 Area Effluent Treatment Facility
17			
18	GC	1	gas chromotography
19 20	HODE		high donaity maly other land
21	HDPE		high-density polyethylene
22	$IC_T$		total inorganic carbon
23	IR		infared
24			Hitti ve
25	LDR		land disposal restriction
26	LERF		Liquid Effluent Retention Facility
27			
28	MS		mass spectrometry
29			
30	N/A	* •	not applicable
31	•		
32	QA.		quality assurance
33	<sup>°</sup> QC		quality control
34	D CD A	D	C In (107)
35	RCRA	Kesource	Conservation and Recovery Act of 1976
36 37	RPD	•	relative percent difference
37 38	TCLP		toxicity characteristic leaching procedure
39	TOC		total organic carbon
40	TSD	•	treatment, storage, and/or disposal
41	100		wantering protugo, and or disposar
42	VOA		volatile organic analysis
43			· · · · · · · · · · · · · · · · · · ·
44	WAC		Washington Administrative Code
45	WAP		waste analysis plan
			·

#### 1

## METRIC CONVERSION CHART

# Into metric units

# Out of metric units

If you know	Multiply by	To get	If you know	Multiply by	To get		
	Length			Length			
inches	25.40	millimeters	millimeters	0.0393	inches		
inches	2.54	centimeters	centimeters	0.393	inches		
feet	0.3048	meters	meters	3.2808	feet		
yards	0.914	meters	meters	1.09	yards		
miles	1.609	kilometers	kilometers	0.62	miles		
, , , , , ,	Area			Area			
square inches	6.4516	square centimeters	square centimeters	0.155	square inches		
square feet	0.092	square meters	square meters	10.7639	square feet		
square yards	0.836	square meters	square meters	1.20	square yards		
square miles	2.59	square kilometers	square kilometers	0.39	square miles		
acres	0.404	hectares	hectares	2.471	acres		
	Mass (weight)		Mass (weight)				
ounces	28.35	grams	grams	0.0352	ounces		
pounds	0.453	kilograms	kilograms	2.2046	pounds		
short ton	0.907	metric ton	metric ton	1.10	short ton		
	Volume		Volume				
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces		
quarts	0.95	liters	liters	1.057	quarts		
gallons	3.79	liters	liters	0.26	gallons		
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet		
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards		
	Temperature		Temperature				
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit		
	Force			Force			
pounds per square inch	6.895	kilopascals	kilopascals	1.4504 x 10 <sup>-4</sup>	pounds per square inch		

Source: Engineering Unit Conversions, M. R. Lindeburg, P.E., Second Ed., 1990, Professional

3 Publications, Inc., Belmont, California.

#### 3.0 WASTE ANALYSIS PLAN

#### 2 3.1 INTRODUCTION

- 3 This waste analysis plan (WAP) addresses analysis necessary to manage the waste at the
- 4 242-A Evaporator according to Resource Conservation and Recovery Act (RCRA) requirements included
- 5 in the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and
- 6 Disposal of Dangerous Waste (Ecology and EPA 1994), Hanford Federal Facility Agreement and
- 7 Consent Order (Tri-Party Agreement, Ecology et., al. 2003, Washington Administrative Code (WAC),
- 8 Chapter 173-303, and Part 264 of the Code of Federal Regulations.
- 9 Modifications of the WAP require modifications of the permit. Permit modifications are discussed in
- 10 Section I.C of the Hanford Facility RCRA Permit and WAC 173-303-830.

#### 11 3.2 PURPOSE

- 12 The purpose of the WAP is to ensure waste at the 242-A Evaporator is managed properly in accordance
- with WAC 173-303-300. To ensure the waste analysis is comprehensive, a data quality objectives (DQO)
- analysis was performed on all streams at the 242-A Evaporator. Sampling and analysis identified in the
- DQO analysis related to meeting RCRA requirements are included as an integral part of this WAP.
- Regulatory and safety issues are addressed in the WAP by establishing boundary conditions for waste to
- be received and treated at the 242-A Evaporator. The boundary conditions are set by establishing limits
- for items such as reactivity, waste compatibility, and control of vessel vent organic emissions. Waste that
- 19 exceeds the boundary conditions would not be acceptable for processing without further actions, such as
- 20 blending with other waste.

#### 21 **3.3 SCOPE**

- 22 This WAP discusses RCRA sampling and analysis of the waste in selected DST System tanks to
- 23 determine the acceptability of the waste for processing at the 242-A Evaporator. Sampling and analysis
- 24 of DST System waste for other reasons, such as preparation for tank-to-tank transfers, is included in the
- 25 waste analysis plan for the DST System.
- 26 RCRA sampling of the process condensate transferred to the Liquid Effluent Retention Facility (LERF)
- 27 can be performed at either the 242-A Evaporator or at LERF. A discussion of process condensate
- 28 sampling at the 242-A Evaporator is included in this WAP, while discussion of process condensate
- 29 sampling at LERF is included in the Hanford Facility RCRA Permit, Attachment 34, Liquid Effluent
- 30 Retention Facility and 200 Area Effluent Treatment Facility, Waste Analysis Plan.
- 31 Samples of other 242-A Evaporator waste streams, such as steam condensate, cooling water, and
- 32 242-A-81 back flush water, are taken as required for process control but are excluded from this plan
- 33 because these streams have been previously characterized and determined to be nondangerous waste
- 34 streams.

35

#### 3.4 242-A EVAPORATOR PROCESS DESCRIPTION

- The 242-A Evaporator, located in the 200 East Area of the Hanford Site, separates the incoming waste
- 37 from the DST System into two aqueous streams as described in the following paragraph. Also associated
- with the 242-A Evaporator are utility waste streams such as cooling water and steam condensate, which
- 39 are not dangerous waste. Description of the waste processed by the 242-A Evaporator is described in
- 40 Section 3.4.

Attachment 35.3.1

- 1 The 242-A Evaporator process uses a conventional forced-circulation, vacuum evaporation system to
- 2 concentrate mixed waste solutions from the DST System tanks. The incoming stream is separated by
- 3 evaporation into two liquid streams: a concentrated slurry stream and a process condensate stream. The
- 4 slurry contains the majority of the radionuclides and inorganic constituents. After the slurry is
- 5 concentrated to the desired amount, the slurry stream is pumped back to the DST System and stored for
- 6 further treatment. Vapor from the evaporation process is condensed, producing process condensate,
- 7 which is primarily water with trace amounts of organic material and a greatly reduced concentration of
- 8 radionuclides. The process condensate is transferred to LERF for storage and treatment. Vacuum for the
- 9 evaporator vessel is provided by two steam jet ejectors, producing a gaseous vessel vent exhaust. The
- 10 242-A Evaporator vessel vent stream is filtered and discharged through an exhaust stack. Figure 3.1
- shows a simplified schematic of the 242-A Evaporator process. A more detailed description of the
- 12 242-A Evaporator process is provided in Attachment 35, Chapter 4.0.

#### 3.5 WASTE IDENTIFICATION

- 14 All of the waste accepted by the 242-A Evaporator comes from DST System. The waste in the DST
- 15 System tanks is received from onsite generators, which characterize the waste before transfer to the DST
- 16 System. Waste characterization is based on analytical data and/or process knowledge. Based on this
- information, the waste in certain DST System tanks are selected as 'candidates' for processing in the
- 18 242-A Evaporator. The contents of these candidate feed tanks are subjected to closer scrutiny and
- evaluated against 242-A Evaporator waste acceptance criteria before the final tank selection is made. To
- 20 meet waste acceptance criteria, the contents of several tanks could be blended together in the feed tank
- 21 (241-AW-102) prior to processing.

#### 22 3.5.1 General Constituent Description

- 23 The only waste stream processed at the 242-A Evaporator is the DST System waste stream, which
- 24 consists of mixed waste received from various Hanford Site activities. The mixed waste is a radioactive
- 25 aqueous solution containing dissolved inorganic salts such as sodium, potassium, aluminum, hydroxides,
- 26 nitrates, and nitrites. The mixed waste in some tanks has detectable levels of heavy metals such as lead,
- 27 chromium, and cadmium. The radionuclide content includes fission products such as the Sr-90 and
- 28 Cs-137, and actinide series elements such as uranium and plutonium. Small quantities of ammonia and
- organics, such as acetone, butanol, and tri-butyl phosphate, could also be present. Waste received in the
- 30 DST System has been chemically adjusted to ensure the waste is compatible with materials used for
- 31 construction of the waste tanks and the 242-A Evaporator. The consistency of the waste in the DST
- 32 System ranges from liquid supernate to thick sludge. Waste fed to the 242-A Evaporator is supernate
- taken from the DST System; the sludge is not processed through the 242-A Evaporator.
- 34 The slurry is an aqueous solution containing the same components as the feed stream with increased
- 35 concentrations. Most of the volatile constituents are evaporated and transferred to the process condensate.
- 36 The process condensate is a dilute aqueous solution with ammonia, volatile organics, and trace quantities
- 37 of radionuclides and inorganic constituents.

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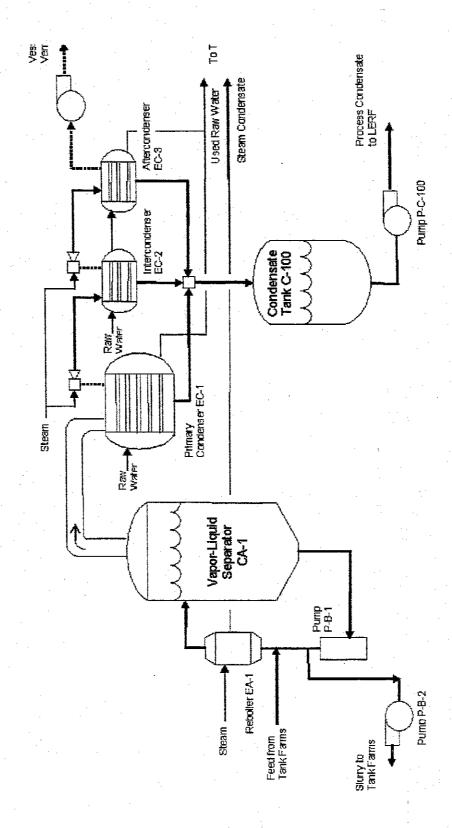
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Figure 3.1. 242-A Evaporator Simplified Schematic



#### 1 3.5.2 Classification of Waste

- 2 The waste processed at the 242-A Evaporator is classified as a mixed waste because it contains
- 3 radioactive components and is a dangerous waste. The concentrated slurry produced by the evaporation
- 4 process is also a mixed waste because it contains the same mixed waste constituents as the waste feed.
- 5 The process condensate is classified as a mixed waste because it contains radioactive components and is a
- 6 listed waste. The process condensate is a listed waste because it is derived from a listed waste.
- 7 Analysis of utility streams which do not contact mixed waste solutions, such as cooling water and steam
- 8 condensate, are conducted per the requirements of the 200 Area Treated Effluent Disposal Facility, which
- 9 receives these streams. These analyses are not discussed in this plan because these streams are not
- dangerous waste under WAC 173-303.

#### 11 3.5.3 Dangerous Waste Numbers

- Waste transferred to the 242-A Evaporator could be assigned any of the dangerous waste numbers found
- in Attachment 35, Chapter 1.0, Part A, Form 3. These numbers are identical to the ones in the Part A,
- 14 Form 3 for the DST System. Because of blending that occurs within the DST System, waste transferred
- to the 242-A Evaporator usually does not display all the characteristics found in the Part A, Form 3s, for
- 16 these TSD units.

23

- 17 Process knowledge and historical data indicate that the slurry stream returning to the DST System
- contains the same dangerous waste constituents as the waste feed, so the same dangerous waste numbers
- are applicable to the feed and slurry.
- Table 3.1 lists the dangerous waste numbers assigned to the process condensate. The process condensate
- 21 is designated with the dangerous waste numbers F001 to F005 because the process condensate is derived
- 22 from treatment of DST System waste assigned these numbers.

#### Table 3.1. Waste Designation for Process Condensate.

Waste number	Characteristic/Source	Basis for designation
F001	Spent halogenated solvents	Derived from F001 waste
F002	Spent halogenated solvents	Derived from F002 waste
F003	Spent nonhalogenated solvents	Derived from F003 waste
F004	Spent nonhalogenated solvents	Derived from F004 waste
F005	Spent nonhalogenated solvents	Derived from F005 waste
F039	Multi-source leachate from waste disposal operations	Future receipt of waste with the F039 number, derived from F001 through F005.

#### 24 3.6 WASTE ACCEPTANCE PROCESS

- 25 This section describes the actions performed before every campaign to determine if the waste in the DST
- 26 System tanks is acceptable for treatment at the 242-A Evaporator. This section also describes the actions
- for sampling the process condensate stream at the 242-A Evaporator, if necessary, to determine if the
- process condensate is acceptable for treatment at the 200 Area Effluent Treatment Facility (ETF).

# 29 3.6.1 Candidate Feed Waste Acceptance Process

- 30 Candidate feed tank sampling performed for this WAP is done in the DST System before transfer of the
- 31 waste to the 242-A Evaporator. Certain DST System tanks are selected as `candidates' for waste to be

Attachment 35.3.4

- processed in the 242-A Evaporator. This section describes the method for determining if the waste in a
- 2 candidate feed tank is acceptable for processing.

# 3 3.6.1.1 Selecting Candidate Feed Tanks

- 4 For each 242-A Evaporator campaign, DST System tanks are selected as candidate feed tanks based on
- 5 process knowledge of chemical properties with respect to waste acceptance criteria (Section 3.6). After a
- 6 candidate tank is selected, the waste in the tank is sampled and analyzed and the data evaluated to confirm
- 7 waste acceptability. Every candidate feed tank is sampled and analyzed to confirm waste acceptability.

# 8 3.6.1.2 Determining the Number of Candidate Feed Tank Samples

- 9 Once a candidate feed tank is selected, the number of tank samples to be taken is determined by statistical
- analysis using existing tank data or data from similar waste in other tanks. Figure 3.2 illustrates the
- decision logic used to determine the number of samples to be taken. Preliminary concentrations of
- critical analytes are compared to the waste acceptability limits to statistically determine the number of
- samples necessary to verify the composition of the waste. The statistical analysis accounts for how close
- the concentrations of critical analytes are to the limits and the desired confidence level. The closer the
- 15 concentrations are to the limits, or the greater the desired confidence level, the more samples must be
- 16 taken. For regulatory compliance, acetone is used as the critical analyte because it is often present at
- 17 elevated levels. A 95% confidence level is specified for acetone. Critical analytes for process control are
- also assessed. Acetone analysis is usually not available from preliminary data, so process control analytes
- 19 (such as nitrate and hydroxide) are often used. The statistical analysis includes the generation of power
- 20 curve calculations using Data Quality Objectives Decision Error Feasibility Trials (EPA 2001 or current
- 21 revision) software developed by the EPA. This software requires input of minimum and maximum
- expected values, action levels, mean sample results, standard deviations of sample results, and upper and
- 23 lower confidence levels. The software outputs the minimum number of samples required. In general,
- 24 three samples are taken as a minimum because taking two samples would require resampling if one
- sample should be lost or contaminated in the laboratory. A maximum of five samples generally is applied
- 26 to minimize exposure to sampling personnel.

#### 27 3.6.1.3 Assessing Candidate Feed Tank Analysis

- When results of the sample analysis are available (and before the waste is processed), a second statistical
- analysis, similar to the first, is performed with the new analyte data to verify a sufficient number of
- 30 samples were taken (Figure 3.3).
- 31 Candidate feed tank sampling and analysis, in conjunction with acceptance criteria in Section 3.6, are
- 32 used to assess whether established limits would be exceeded. Based on the results, three possible options
- 33 are implemented:
  - The waste is acceptable for processing at the 242-A Evaporator without further actions.
- The waste is unacceptable for processing as a single batch, but is acceptable if blended with other waste to be processed.
- The waste is unacceptable for processing.
- 38 If the waste is suitable for evaporation, it will be transferred to the feed tank (241-AW-102) for
- 39 processing.

34

# 1 3.6.2 Process Condensate Waste Sampling Process

- 2 RCRA sampling of process condensate is completed per the LERF/ETF WAP (HNF-SD-ENV-WAP-008)
- 3 before treatment at the ETF. Depending on programmatic needs, this sampling can be performed at the
- 4 242-A Evaporator during a campaign or at LERF after the campaign is completed.
- 5 Before the start of a 242-A Evaporator campaign, the decision whether process condensate sampling will
- 6 be performed at the 242-A Evaporator or at LERF is documented in the operating record. Planning for
- 7 process condensate sampling at the 242-A Evaporator (i.e., number of samples, when samples are taken,
- 8 etc.) is completed before starting the campaign.

# 9 3.6.2.1 Determining the Number of Process Condensate Samples

- The purpose of sampling the process condensate stream at the 242-A Evaporator is to confirm that the
- stream is acceptable for treatment at the ETF. Before starting a 242-A Evaporator campaign where
- sampling will be performed at the 242-A Evaporator instead of LERF, characterization of the process
- condensate will be developed based on process knowledge. Process knowledge includes previous
- 14 documented process condensate analysis, estimated concentrations based on documented candidate feed
- tank analysis, etc. RCRA sampling of the process condensate stream at the 242-A Evaporator is
- performed during the campaign to confirm the characterization is correct. Sampling frequency is
- 17 determined using the following equation:
- Number of process condensate = N + 1 samples required (per campaign). Where N is the number of candidate feed tanks to be processed during the campaign.
- 20 For example, a campaign processing waste from only one candidate feed tank would require two samples,
- while a campaign processing waste from three candidate feed tanks would require four samples. Sampling
- 22 is spread approximately evenly through the campaign, allowing for operational events such as unexpected
- 23 shutdowns and planned maintenance outages. This sample frequency represents a confirmation rate of
- 24 about one sample every 5 to 8 days of processing. This is reasonable based on the extensive database of
- previous process condensate analysis. A minimum of two samples is taken to allow averaging of results.

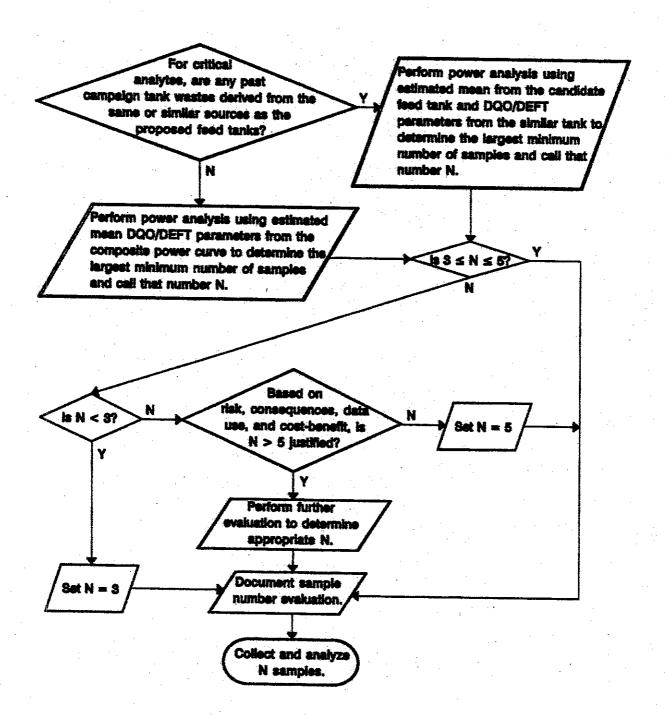
#### 26 3.6.2.2 Assessing Process Condensate Analysis

- 27 The process condensate sample results are assessed against the requirement in the LERF/ETF WAP
- 28 (HNF-SD-ENV-WAP-008). The discussion of the waste management decision process for process
- 29 condensate sampling, including the reevaluation process, is also included in the LERF/ETF WAP.

#### 30 3.7 242-A EVAPORATOR ACCEPTANCE CRITERIA

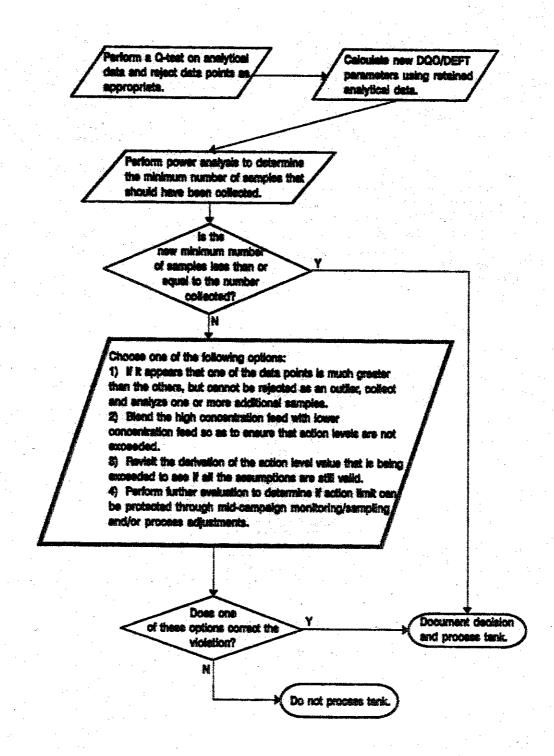
- 31 Acceptance criteria for the 242-A Evaporator have been established from regulatory requirements,
- 32 operating experience, previous sample analyses, and engineering calculations. Processing criteria are
- 33 maximum and/or minimum values of a waste analyte that, if exceeded, alert the operator that management
- of the waste requires further attention. The rationale for selecting a given analyte for inclusion in this
- WAP, as required by WAC 173-303-300, is indicated in this section.
- 36 Additional analyses (such as specific gravity and radionuclide analysis) of the feed tanks, process
- 37 condensate, and other streams are performed to ensure that the facility is operating within established
- parameters. This process control sampling and analysis is outside the scope of this plan because it is not
- 39 used to assess compatibility of the waste with other waste and with the 242-A Evaporator tank systems.

Figure 3.2. Strategy for Determining the Number of Candidate Feed Tank Samples.



2

Figure 3.3. Strategy for Verifying the Number of Candidate Feed Tank Samples.



### 3.7.1 Candidate Feed Tank Waste Acceptance Criteria

- 2 The following sections discuss waste acceptance criteria for candidate feed tanks to be processed in the
- 3 242-A Evaporator.

4

#### 3.7.1.1 Exothermic Reactions

- 5 WAC 173-303-395 requires waste handling be conducted to prevent an uncontrolled reaction that could
- 6 damage the tank system structural integrity or threaten human health or the environment. To evaluate the
- 7 possibility of an uncontrolled reaction at the elevated temperatures in the evaporator vessel, a differential
- 8 scanning calorimeter (DSC) test is performed on sample of all candidate waste to be processed. DSC
- 9 measures the amount of heat absorbed or released by a sample as the temperature is increased. Waste
- 10 exhibiting exotherms below 168°C, or with an absolute value of the exotherm-to-endotherm ratio greater
- than one, will not be processed in the 242-A Evaporator without further technical evaluation.

#### 12 3.7.1.2 Compatibility

- 13 WAC 173-303-395 requires waste handling be conducted to prevent an uncontrolled reaction that could
- damage the tank system structural integrity or threaten human health or the environment. To verify there
- will be no adverse affects because of mixing the contents of different waste tanks in the feed tank and
- evaporator vessel, a compatibility evaluation is performed on waste in the candidate feed tanks. As
- samples from each of the planned waste sources are mixed, observations are made to note any changes in
- 18 color, temperature, clarity, or any other visually determinable characteristic. This would indicate an
- 19 unexpected chemical reaction that might have an impact on 242-A Evaporator operations. If such visible
- 20 changes are observed when mixing samples, the waste would not be processed in the 242-A Evaporator
- 21 without further technical evaluation.

## 22 3.7.1.3 Organic Constituents

- 23 The 242-A Evaporator performs distillation of waste containing organic concentrations greater than
- 24 10 parts per million by weight; therefore, organic air emissions are subject to WAC 173-303-690 (which
- 25 incorporates 40 CFR 264, Subpart AA, by reference). Organic emissions from TSD units on the Hanford
- 26 Site subject to 40 CFR 264, Subpart AA are controlled to ensure emissions to do not exceed
- 27 1.4 kilograms per hour and 2,800 kilograms per year. To ensure these requirements are met, the levels of
- volatile organics in the 242-A Evaporator feed must be limited to prevent excessive organic emissions
- 29 during processing. Engineering calculations were used to determine the feed limits given in Table 3.2.
- 30 The limits include a modifier "(R-1)/R", which adjusts the limits based on the campaign's planned boiloff
- 31 rate. R is the ratio of feed flow rate to slurry flow rate. Typically, R is equal to 2, making (R-1)/R equal
- 32 to 0.5.
- In addition, analysis of the individual components in Table 3.2, total carbon  $(C_T)$  and total inorganic
- carbon (IC<sub>T</sub>) analysis are performed as a screening tool to account for other organic species that might be
- 35 present in the waste. The value of C<sub>T</sub> minus IC<sub>T</sub> represents the total organic concentration in the waste. If
- 36 the C<sub>T</sub> minus IC<sub>T</sub> limit is exceeded, additional volatile organic species might be present and a more
- 37 detailed evaluation will be conducted to determine organic emissions out of the vessel vent. The limit for
- 38 evaluation is 174.4 milligrams per liter, based on the conservative assumption that all organic species
- 39 present in the waste are as volatile as acetone. Acetone was chosen because of its relatively high
- 40 volatility and low percentage of carbon.
- 41 The level of volatile organics in the feed must also be limited to ensure organic constituents that transfer
- 42 to the process condensate are compatible with the LERF liner. The high density polyethylene (HDPE)
- 43 liner used at the LERF is exposed to process condensate that could contain trace quantities of chemicals
- 44 that could cause degradation of the liner material. Based on the liner manufacturer's compatibility data,

- the concentration limits in Table 3.3 are imposed on those classes of constituents that could potentially
- 2 degrade the liner. To ensure that these limits are not exceeded in the process condensate, the
- 3 concentration limits are applied to the candidate feed tanks as well, with the modifier "(R-1)/R". A
- 4 C<sub>T</sub> minus IC<sub>T</sub> analysis, similar to the one described previously, is also applied to the LERF liner limits.
- 5 The strictest limit for organic species in Table 3.3 is 2,000 milligrams per liter. Assuming the organic is
- 6 acetone (with its low percentage of carbon); this converts to a carbon value of 1,240 milligrams per liter.
- 7 The calculations in Tables 3.2 and 3.3 require use of the 'sum of the fractions' technique. A calculation is
- 8 performed where the analysis of each constituent is divided by its associated limit to produce a fraction of
- 9 the limit. If the sum of these fractions is less than 1, the waste meets the requirements in the tables.

## 3.7.2 Process Condensate Acceptance Criteria

- 11 The waste acceptance criteria for process condensate sampling, including treatability, LERF liner
- 12 compatibility, compatibility with other waste, etc., is given in the LERF/ETF WAP
- 13 (HNF-SD-ENV-WAP-008).

10

14

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Table 3.2. Candidate Feed Tank Limits for Vessel Vent Organic Discharge<sup>a</sup>.

Feed constituent	Limit (milligrams per liter) b, c
Acetone	174.4 ([R-1]/R)
1-Butanol	452 ([R-1]/R)
2-Butoxyethanol	190.4 ([R-1]/R)
2-Butanone	116 ([R-1]/R)
Tri-butyl phosphate	2.03E+4 ([R-1]/R)
Total carbon and Total inorganic carbon	(CT-ICT) < 174.4 ([R-1]/R) (as acetone)

<sup>&</sup>lt;sup>a</sup> Limits are based on a maximum continuous operating time equivalent to 6 months per year. If total operating time is expected to exceed 6 months per year, the limits must be re-evaluated.

$$\sum_{n=1}^{i} \left( \frac{Conc_n}{LIMIT_n} \right) \le 1$$

<sup>&</sup>lt;sup>b</sup> The limits are applied using the sum of the fractions technique: where i is the number of organic constituents detected in analysis of the waste feed tank. Total carbon and total inorganic carbon analysis are not part of the summation.

 $<sup>^{</sup>c}$  R is the ratio of feed flow rate to slurry flow rate (typically R = 2).

Table 3.3. Candidate Feed Tank Limits for LERF Liner Compatibility <sup>f</sup>

	· ·	•
Chemical family/parameter <sup>a</sup>	Current target compounds	Limit (milligrams per liter) <sup>b,c</sup>
Alcohol/glycol	1-Butanol	500,000 ([R-1]/R)
Alkanone d	Sum of acetone, 2-butanone	200,000 ([R-1]/R)
Alkenone <sup>e</sup>	None targeted	2,000 ([R-1]/R)
Aromatic/cyclic hydrocarbon	None targeted	2,000 ([R-1]/R)
Halogenated hydrocarbon	None targeted	2,000 ([R-1]/R)
Aliphatic hydrocarbon	None targeted	500,000 ([R-1]/R)
Ether	2-Butoxyethanol	2,000 ([R-1]/R)
Other hydrocarbons	Tri-butyl phosphate	2,000 ([R-1]/R)
Oxidizers	None targeted	1,000 ([R-1]/R)
Acids, bases, and salts	Ammonia	100,000 ([R-1]/R)
Total carbon and total inorganic carbon	Not applicable	$(C_T-IC_T) < 1,240 ([R-1]/R)$ (as acetone)

a If a chemical fits in more than one chemical family, the more restrictive limit applies.

$$\sum_{n=1}^{i} \left( \frac{Conc_n}{LIMIT_n} \right) \le I$$

- c R is the ratio of feed flow rate to slurry flow rate (typically R = 2).
- d Ketone containing only saturated alkyl group(s)
- e Ketone containing unsaturated alkyl group(s)
- f This table is used to ensure process condensate generated from candidate feed tank treatment is within LERF liner compatibility limits

b The limits are applied using the sum of the fractions technique: where i is the number of constituents detected in analysis of the waste feed tank. Total carbon and total inorganic carbon analysis are not part of the summation.

## 1 3.8 SAMPLE COLLECTION AND ANALYSIS

- 2 This section discusses sampling and analysis, including sampling procedures, sample collection points,
- 3 sample quality assurance/quality control (QA/QC), and selection of analytes.

## 4 3.8.1 Sample Collection

- 5 This section describes collection of candidate feed tank and process condensate samples for RCRA
- analysis. Candidate feed tank waste is sampled and analyzed before the start of each 242-A Evaporator
- 7 campaign. Process condensate samples are taken at the 242-A Evaporator only if the decision is made
- 8 before the start of the campaign that sampling will be done at the 242-A Evaporator instead of LERF.

# 9 3.8.1.1 Candidate Feed Tank Sample Collection

- Candidate feed tank samples are obtained by using a grab sampling method (e.g. "bottle on a string
- method") specified in ASTM E300, Standard Practices for Sampling Industrial Chemicals (ASTM 1986).
- 12 The number of lateral sampling locations in candidate feed tanks is limited by the availability of tank
- risers providing access into the tank. Generally, only a few risers in each tank are actually available for
- sampling because the risers are dedicated to instrumentation or other uses. Sampling within a vertical
- 15 column is generally limited only by the depth of waste in the tank. The criteria in Table 3.4 are used
- when determining the specific sampling locations.
- 17 Riser selection is made by numbering the available risers that are at least 4.6 meters from each other and
- using a random number generator to select which risers will be used. Sample depths are determined by
- dividing the tank level into 1-foot increments and using a random number generator to determine a depth,
- which meets the criteria given in Table 3.4.

# 21 3.8.1.2 Candidate Feed Tank Sampling Quality Assurance and Quality Control

- 22 For each candidate feed tank sample, a sample solution is drawn from the sample riser using one or more
- 23 sample bottles. All sample bottles are precleaned, amber-colored glass bottles sealed with Teflon\* caps
- or septum caps and lined septums; however, the sample bottle for VOA must be sealed with septum cap
- 25 and lined septum.
- 26 For candidate feed tank sampling quality control, one field blank, consisting of one or more sample
- bottles, is taken during the sample event. Field blanks are inserted approximately 1-foot into any one of
- 28 the sample risers used during the sample event. One trip blank, also consisting of one or more sample
- 29 bottles, is taken during each sample event. Trip blanks are analyzed as independent samples for VOA.
- 30 Field and trip blanks use the same types of sample bottles as the actual samples and are filled with
- 31 reagent-grade water before shipment to the field.
- 32 Preservatives are not used with candidate feed tank samples because of concerns with high radiation
- exposure that would result from additional handling of sample solutions. It is not practical to refrigerate
- 34 the bulky, shielded sample pigs and shipping containers. Biological activity, generally the largest
- 35 problem in environmental samples, is unlikely in candidate feed tank samples because of the high salt
- 36 content, pH, and radioactivity.

<sup>\*</sup>Teflon is a trademark of E.I. DuPont de Nemours & Company

- 1 The chain of custody is documented on a data sheet that includes a unique sample number, date and time
- sample was taken, custody seal number, and signature of the sampler. When possession of the sample is
- 3 transferred to other persons, such as the shipper or laboratory, the signature of the relinquisher and
- 4 receiver are recorded, along with date and time of the transfer. The receiver at the laboratory also
- 5 documents on the data sheet that the sample seal number is correct and the seal is intact. The chain-of-
- 6 custody data sheets are included in the operating record.

#### 3.8.1.3 Process Condensate Sample Collection

- 8 Process condensate samples, when performed at 242-A Evaporator instead of LERF, are taken from the
- 9 process condensate transfer line in the condenser room of the 242-A Building. Grab sampling is
- 10 performed during the campaign on the transfer line downstream of the ion exchange column at the
- 11 SAMP-RC3-2 sampler or other sample port. Samples of process condensate are collected in a manner
- 12 consistent with SW-846 procedures (EPA 1986) as documented in sampling procedures, which are
- maintained and implemented by unit personnel.

## 14 3.8.1.4 Process Condensate Sampling Quality Assurance and Quality Control

- 15 For information on process condensate sample collection, including the number and types of sample
- bottles, sampling QA/QC, etc., refer to the LERF/ETF WAP (HNF-SD-ENV-WAP-008).

# 17 3.8.2 Analyte Selection and Rationale

- 18 The DQO analysis for the 242-A Evaporator examined the data needs for sampling the candidate feed
- tanks and determined that the analyses in Table 3.5 should be conducted to satisfy WAC 173-303-300
- 20 requirements. Table 3.5 also contains the rationale for these parameters being selected. Section 3.6
- 21 provides additional detail on the rationale.
- 22 For information on process condensate sample analyte selection and rationale, refer to the LERF/ETF
- 23 WAP (HNF-SD-ENV-WAP-008).

Table 3.4. Candidate Feed Tank Sample Point Selection.

Number of samples	Location of sample points
Two samples	One sample taken from the upper half of the waste from one riser and the other sample taken from the lower half of the waste from another riser.
Three samples	Two Samples taken from one riser (one from the top half and the other from the bottom half of the waste) and one sample from another riser
Four samples	Two samples taken from each of two separate risers. One sample is to be taken from the top half of the waste and one from the bottom half of the waste from each of the selected risers.
Five samples	Same as for four samples except one sample from either the top or bottom half of the tank will be taken from a third riser

7

Table 3.5. Analytes for Candidate Feed Tanks.

Parameter	Test technique	Analyte	Rationale
Exotherm	Differential scanning calorimeter	Temperature and energy	Verify the waste will not undergo an exothermic reaction (Section 3.6.1.2).
Compatibility test	Mixing and compatibility study	Visual physical changes	Verify the waste is chemically compatible (Section 3.6.1.3).
Organic compounds	Gas chromatograph/ mass spectrometer	Acetone, 1-Butanol, 1-Butoxyethanol, 1-Butanone, Tri-butyl phosphate	Used in calculations to verify that vessel vent emissions will not exceed regulatory limits and to prevent compatibility problems with the LERF liner (Section 3.6.1.4).
	Carbon coulometric detector	Total carbon, Total inorganic carbon	Used in calculations to verify that vessel vent emissions will not exceed regulatory limits and to prevent compatibility problems with the LERF liner (Section 3.6.1.4).
Ammonia	Ion selective electrode	Ammonia	To prevent compatibility problems with the LERF liner (Section 3.6.1.45.1.3).

## 2 3.9 ANALYTICAL METHODS AND QUALITY ASSURANCE AND QUALITY CONTROL

- 3 This section provides information on the analytical methods and QA/QC for candidate feed tank samples,
- 4 including discussions concerning laboratory selection and analytical methods. For information on process
- 5 condensate analytical methods and QA/QC, refer to the LERF/ETF WAP (HNF-SD-ENV-WAP-008).

#### 6 3.9.1 Laboratory Selection

- 7 Because of the samples, it is anticipated that candidate feed tank sample analyses will be conducted at the
- 8 222-S Laboratory Complex. Other laboratories at the Hanford Facility could be used provided they are
- 9 equipped to handle such samples. Laboratory selection depends on availability, analytical needs, and the
- ability of the laboratory to meet permit and quality assurance requirements.

#### 3.9.2 Analytical Methods

11

- 12 The analytical methods that must be followed for RCRA sampling of the candidate feed tanks are
- included in Table 3.5. Performance-based specifications rather than procedure-based specifications are
- used for determining the appropriate analytical methods. This allows for necessary adjustments to the
- methods for Hanford Facility-specific issues; related to high radioactivity of the sample matrix, while
- ensuring acceptable data quality. Because of the high radioactivity, the analytical method will in some
- 17 cases deviate from those in national standards such as Test Methods For Evaluating Solid Waste, SW-846
- 18 (EPA 1986) and Standard Methods for the Examination of Water and Waste Water (AWWA 1989).

#### 19 3.9.3 Laboratory Quality Assurance and Quality Control

- 20 Candidate feed tank analytical and sampling methods conducted as part of this plan meet the data quality
- 21 requirements contained in Table 3.7. Quality control check samples (i.e., calibration samples and/or
- 22 laboratory control samples) generally are performed once per sample event (e.g., once for all samples
- from one candidate feed tank). Matrix spike and duplicate analysis are performed once per sample event
- 24 for all methods except differential scanning calorimetry (DSC). A duplicate analysis is performed for
- 25 DSC analysis to determine method precision. Accuracy for DSC is evaluated by using the laboratory
- 26 control standard.

- The QA/QC program for sampling and analysis related to this unit must, at a minimum, comply with the applicable Hanford Site standard requirements and the regulatory requirements. All analytical data will
- 3 be defensible and will be traceable to specific, related quality control samples and calibrations.

Table 3.6. Analytical Methods for Candidate Feed Tank Stream Analytes.

Category	Analyte	Performance- based analytical methods	Basis for method	Equipment/Method
Organics	Acetone	Purge and trap	SW-846	A diluted sample is purged with nitrogen or helium
Organics	2-Butanol 2-Butanone	and GC/MS (VOA)	Method 8260	and organic vapors are trapped in an adsorbent column. The column is desorbed at 180° C into a 30-m long wide- or narrow-bore capillary column. The GC column is heated/desorbed into an MS for analysis.
	2-Butoxyethanol	Solvent	SW-846	A diluted sample is adjusted to pH <2 (pH <6 in
	Tri-butyl phosphate	extraction and GC/MS (semi-VOA)	Method 3520B and 8270A	some cases) using sulfuric acid solution. The sample is placed in a continuous liquid-liquid extractor using methylene chloride as the extractant. The extractant is placed in an evaporator and volume is reduced.  The extractant is injected into a GC/MS for analysis.
Inorganic	Ammonia	Ion selective	AWWA	The sample is preserved by the addition of
•		electrode	Method 4500-NH3	hydrochloric acid solution to pH <2. For analysis, a diluted sample is made alkaline by sodium hydroxide solution. The ammonia is measured by an ammonia gas sensing electrode. A standard
]	·			ammonium chloride solution is added and measured
				by the electrode in two stages. Based on the three
1				readings, an ammonia concentration is calculated.
Other	Exotherm	Differential scanning calorimeter	N/A	A sample is placed in the DSC unit and heated to 500° C. The differential heat flow between the sample and a reference pan is monitored by thermocouples. A duplicate sample is run on the equipment.
	Mixing and compatibility study	Lab specific	N/A	Solution from each sample are mixed and visually checked for gas evolution, heat generation, precipitation, dissolution of solids, color change, clarity, and any other observable characteristics.
	Total carbon	Combustion	Combustion and	A diluted sample is injected into a furnace heated to
		with IC <sub>T</sub> /TOC coulometric detection OR	persulfate treatment: AWWA Method 5310	800° C while purged with oxygen. The furnace converts carbon to carbon dioxide, which is carried by the oxygen. The gas sample passes through adsorbent columns to remove acid vapors, sulfur
		Persulfate oxidation with IC <sub>T</sub> /TOC	Coulometry: ASTM D4129	oxides and nitrogen oxides. The carbon dioxide is absorbed in an organic solution and measured with a coulometric carbon analyzer.
		coulometric detection	(AWWA approval pending)	OR: A diluted sample is acidified with sulfuric acid, converting inorganic carbon to carbon dioxide. The
				sample purged with oxygen, stripping the carbon dioxide. Then, persulfate is added to the sample to oxidize the organic carbon. The sample is again acidified with sulfuric acid and purged with oxygen.
				The gas samples from both steps pass through an adsorbent column to remove acid vapors, suifur oxides and nitrogen oxides. The carbon dioxide is absorbed in an organic solution and measured with a coulometric carbon analyzer.

Category	Analyte	Performance- based analytical methods	Basis for method	Equipment/Method	
	Total Inorganic Carbon	Acidification with IC <sub>T</sub> /TOC coulometric detection	Acidification: AWWA Method 5310.	A diluted sample is acidified with sulfuric acid/sulfamic acid, converting inorganic carbon to carbon dioxide. The sample purged with oxygen, stripping the carbon dioxide. The gas sample passes	
		document	Coulometry: ASTM D4129 (AWWA approval pending) GC/MS - gas	through scrubbers to remove acid vapors, sulfur oxides and nitrogen oxides. The carbon dioxide is absorbed in an organic solution and measured with a coulometric carbon analyzer.	
			chromatography/m ass spectrometry VOA - volatile organic analysis		
			IC <sub>T</sub> - total inorganic carbon TOC - total organic carbon		

Table 3.7. Quality Assurance Requirements for Candidate Feed Tank Stream Analytes.

<u> </u>					
Category	Analyte	Estimated quantitation limit (matrix specific)	Precision (RPD between duplicates), %	Accuracy (recovery of matrix spike <sup>1</sup> ), %	Action level <sup>2</sup>
Organics	Acetone	28 mg/L	<25	40-110	> 87 mg/L <sup>3</sup>
	1-Butanol	20 mg/L	<25	30-110	$> 226 \text{ mg/L}^3$
	2-Butoxyethanol	30 mg/L	<25	30-110	$> 95.2 \text{ mg/L}^3$
	2-Butanone (methyl ethyl ketone)	18 mg/L	<25	40-110	> 58 mg/L <sup>3</sup>
	Tri-butyl phosphate	50 mg/L	<25	40-125	> 1.015E+4 mg/L <sup>3</sup>
Inorganic	Ammonia	$400  \mu \mathrm{g/ml}$	<20	75-125	> 50,000 mg/L
Other	Exotherm	None	<20⁴	Not applicable <sup>4</sup>	< 168 °C or absolute value of ratio of exotherm to
					endotherm > 1
	Mixing and compatibility study	Not applicable	Not Applicable	Not Applicable	Visual: unusual changes in color, temperature, clarity, etc.
	Total carbon	25 μg/mL	<20	75-125	$C_T$ -I $C_T$ > 87 mg/L
	Total inorganic carbon	25 μg/mL	<20	75-125	$C_T$ -I $C_T$ > 87 mg/L

Reserved.

In deriving the action levels, the ratio of feed flow rate to slurry flow rate (R) is assumed to be 2.

For organic species limits, sum of the fractions rule apply (refer Tables 3.2 and 3.3). Total carbon and total inorganic carbon are not included in the summation of organics.

Precision for this method is evaluated by the deviation between sample (unspiked) and sample replicate.

Accuracy for DSC is evaluated by using the laboratory control standard.

RPD - relative percent difference

C<sub>T</sub> - total inorganic carbon

IC<sub>T</sub> - total inorganic carbon

mg/L - milligram per liter

 $\mu$ g/L - microgram per liter

#### 3.10 REFERENCES

- 2 ASTM, 1986, Standard Practice for Sampling Industrial Chemicals, ASTM E300-86, American Society
- for Testing and Materials, West Conshohocken, Pennsylvania, updated periodically.
- 4 ASTM, 1988, Total and Organic Carbon in Water by High Temperature Oxidation and Coulometric
- 5 Detection, ASTM D4129-88, American Society for Testing and Materials, West Conshohocken,
- 6 Pennsylvania, updated periodically.
- 7 AWWA, 1989, Standard Methods for the Examination of Water and Wastewater, 17th edition, American
- 8 Public Health Association/America Water Works Association, Washington, D.C., updated periodically.
- 9 DOE/RL, 1988, Hanford Facility Dangerous Waste Part A Permit Application, DOE/RL-88-21,
- 10 U.S. Department of Energy Richland Field Office, Richland, Washington, updated periodically.
- 11 DOE/RL-97-03, Hanford Facility Dangerous Waste Permit Application, Liquid Effluent Retention
- 12 Facility and 200 Area Effluent Treatment Facility, Revision 0, U.S. Department of Energy, Richland
- 13 Operations Office, Richland, Washington.
- 14 Ecology and EPA, 1994, Hanford Facility Resource Conservation and Recovery Act Permit for the
- 15 Treatment, Storage, and Disposal of Dangerous Waste, Permit Number WA7890008967, Washington
- State Department of Ecology, Olympia, Washington and U.S. Environmental Protection Agency
- 17 Region 10, Seattle Washington.
- 18 Ecology, EPA, and DOE, 1996, Hanford Federal Facility Agreement and Consent Order, as amended,
- Washington State Department of Ecology, Olympia, Washington, U.S. Environmental Protection
- 20 Agency Region 10, Seattle, Washington, and U.S. Department of Energy Richland Operations Office,
- 21 Richland, Washington.
- 22 EPA, 1986, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846,
- U.S. Environmental Protection Agency, Washington, D.C., updated periodically.
- 24 EPA, 1994a, Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Wastes,
- 25 A Guidance Manual, PB94-963603, OSWER 9938.4-03, U.S. Environmental Protection Agency,
- 26 Washington D.C.
- 27 EPA, 1994b, Data Quality Objectives Decision Error Feasibility Trials, EPA QA/G-4D, Version 4.0,
- 28 U.S. Environmental Protection Agency, Washington D.C.

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#### 4.0 PROCESS INFORMATION

- 2 The 242-A Evaporator receives mixed waste from the DST System that contains inorganic and organic
- 3 constituents and radionuclides. A 242-A Evaporator simplified process flow diagram is given in
- 4 Figure 4.1. The 242-A Evaporator separates the mixed waste received from the DST System, generating
- 5 the following waste streams:
- A concentrated aqueous waste stream (slurry) containing the nonvolatile components, including most
   of the radionuclides, inorganic constituents, and nonvolatile organics such as tri-butyl phosphate
- 8 A dilute aqueous waste stream (process condensate) containing the volatile components, primarily
- 9 water with low concentrations of radionuclides, inorganic constituents, and volatile constituents such
- 10 as ammonia and acetone.
- 11 The slurry is routed back to the DST System pending further treatment. The process condensate is
- 12 transferred to the LERF for storage until processed through the ETF.
- 13 The 242-A Evaporator process employs a conventional forced circulation, vacuum evaporation system to
- 14 concentrate the DST System waste solution. The major components of this system include the reboiler,
- 15 vapor-liquid separator, recirculation pump and pipe loop, slurry product pump, condenser, jet vacuum
- 16 system, and condensate collection tank
- 17 The vapor-liquid separator, C-A-1, also called the evaporator vessel, and the condensate collection tank.
- 18 C-100, meet the definition of a tank in WAC 173-303-040. Other process equipment associated with
- 19 these tank systems is considered ancillary equipment. Drawings that aid in understanding the systems are
- 20 provided in Section 4.3.
- 21 The 242-A Evaporator receives waste from a DST System tank, 241-AW-102 that serves as the
- 22 242-A Evaporator feed tank. The feed enters the recirculation line and blends with the main process
- 23 slurry stream, which is pumped to the reboiler.
- 24 In the reboiler, the mixture is heated to the specified operating temperature, normally 38 to 77°C, using
- 25 21 to 69 kilopascals gauge pressure steam. The low-pressure steam provides adequate heat input, and the
- 26 resulting low-temperature differential across the reboiler minimizes scale formation on the heat transfer
- 27 surfaces. The static pressure of the waste in the reboiler is sufficient to suppress the boiling point so the
- 28 waste does not boil in the reboiler tubes. Boiling occurs only near or at the liquid surface in the
- 29 vapor-liquid separator.
- 30 The heated slurry stream is discharged from the reboiler to the vapor-liquid separator (C-A-1) that
- 31 typically is maintained at an absolute pressure of 5.3 to 10.7 kilopascals. Under this reduced pressure, a
- 32 fraction of the water in the heated slurry flashes to steam and the steam is drawn through two, wire mesh
- 33 deentrainer pads into a 42-inch diameter vapor line that leads to the primary condenser, leaving behind a
- 34 more concentrated slurry solution in the vapor-liquid separator.
- 35 After a brief residence time in the vapor-liquid separator, the slurry exits from the bottom through the
- 36 lower recirculation line and is recirculated by the recirculation pump (P-B-1). The pump discharges the
- 37 slurry back to the reboiler via the upper recirculation line, thus completing the recirculation loop.
- 38 The specific gravity of the waste liquid is monitored closely to ensure that the target density, established
- 39 before the beginning of the campaign, is not exceeded. A portion of the slurry is removed from the upper
- 40 recirculation line using the slurry pump (P-B-2) and transferred through an encased underground pipeline
- 41 (pipe-within-a-pipe) to a designated slurry receiver tank in the DST System.
- 42 Vapors are drawn from the vapor-liquid separator through a 42-inch diameter vapor line and enter a series
- 43 of three condensers where the vapors are condensed using raw water. The condensed vapors, called
- 44 process condensate, are collected in tank C-100. Steam jets are used to create a vacuum on the

- 1 vapor-liquid separator drawing the process vapors into and through the condensers. Noncondensable
- 2 vapors are drawn from the condensers through a series of particulate filters and vented to the atmosphere.
- 3 The air discharges are monitored continuously when the 242-A Evaporator is operating to verify that
- 4 standards for radionuclide and ammonia emissions standards are met.
- 5 Process condensate contains the volatile constituents of the waste and trace quantities of inorganic
- 6 materials and radionuclides. The process condensate is pumped from tank C-100 through an encased
- 7 underground pipeline (pipe-within-a-pipe) to the LERF.
- 8 During a campaign, the evaporation process is continuous with typical feed flow rates of 260 to 450 liters
- 9 per minute, process condensate flow rates of 150 to 230 liters per minute, and slurry flow rates of 110 to
- 10 230 liters per minute. The evaporator process is shutdown when the desired endpoint concentration of the
- 11 slurry is met. Endpoints are established at the beginning of the campaign, based on allowable waste
- 12 volume reduction (WVR) and defined operating limits. If the evaporation rate cannot achieve the desired
- 13 endpoint, slurry in the DST System serving as the slurry receiver is transferred to the feed tank for one or
- 14 additional passes through the 242-A Evaporator. At the end of each campaign, the 242-A Evaporator
- 15 process equipment is shutdown, emptied, flushed with raw water, and placed in a safe standby mode.
- 16 Other discharges during 242-A Evaporator processing include condensate from the steam used to heat the
- 17 waste and cooling water used to condense the vapors. The 242-A Evaporator is designed to prevent
- 18 contamination of these streams. The fluids on the uncontaminated side of the heat exchangers are
- 19 maintained at a higher pressure than the waste stream so that uncontaminated fluid migrates toward the
- 20 contaminated waste if a leak were to occur. The steam condensate is discharged to the TEDF. The
- 21 cooling water is monitored continuously for radiation and discharged to TEDF as long as the discharge
- 22 radiation limits are not exceeded. The steam condensate and cooling water streams were assessed in the
- 23 stream specific reports (WHC 1990a and WHC 1990b) and are not dangerous waste in accordance with
- 24 WAC 173-303.
- 25 The 242-A Evaporator process is controlled by the MCS. The MCS computer monitors all process
- 26 parameters and controls the parameters where required. Once the configuration parameters and other
- 27 process control inputs are set, the MCS functions independently of the operator, maintaining the process
- 28 parameters within specified ranges by sending output signals that operate specific pieces of equipment
- 29 (e.g., control valves).

#### 30 4.1 TANK SYSTEMS

- 31 This section discusses information associated with design requirements, integrity assessments, and any
- 32 additional requirements for tanks used to treat and store mixed waste in the 242-A Evaporator.

## 33 4.1.1 Design Requirements

- 34 The following design requirements were addressed in the 242-A Evaporator/Crystallizer Tank System
- 35 Integrity Assessment Report (IAR) (Attachment 35, Appendix 4B):
- 36 Minimum design wall thicknesses and measured wall thicknesses at various points throughout the
- 37 tank systems
- 38 Design standards used in construction, including references
- 39 Waste characteristics
- 40 Materials of construction and compatibility of materials with the waste being processed
- 41 Corrosion protection
- 42 Seismic design basis evaluation.

Attachment 35.4.2

- 1 The conclusion of the integrity assessment report is that the 242-A Evaporator system is not leaking and
- 2 is fit for use. The inspections, tests, and analyses performed provide assurance that the tank system has
- 3 adequate design, sufficient structural strength, and sufficient compatibility with the waste to not collapse,
- 4 rupture, or fail during operation. The report also states that a review of construction files indicates that
- 5 the building structure was designed and constructed to withstand a design-basis earthquake.

#### 6 4.1.2 PC-5000 Transfer line

- 7 Aqueous waste from the 242-A Evaporator is transferred to the Liquid Effluent Retention Facility (LERF)
- 8 through the PC-5000 waste transfer line. The below grade transfer line, is a 3-inch carrier pipe within a
- 9 6-inch outer containment pipeline, approximately 1,500 meters long. This permit includes the portion of
- 10 the PC-5000 line leaving the 242-A Evaporator facility to the fence line of LERF.

## 11 4.1.3 Vapor-Liquid Separator (C-A-1) and Ancillary Equipment

- 12 The following sections describe the vapor-liquid separator (C-A-1) and ancillary equipment.
- 13 Waste Feed System. Feed to the 242-A Evaporator is supplied via a pump located in the
- 14 241-AW-102 feed tank. The feed pump transfers the waste to the 242-A Evaporator through a 3-inch
- 15 diameter carbon steel transfer pipeline encased in a 6-inch diameter carbon steel pipe to provide
- 16 secondary containment. The feed pipeline is equipped with a leak detection system.
- 17 Samples can be taken from the waste feed when needed. The feed sampler (SAMP-F-1) is located in a
- 18 sample enclosure located in the load out and hot equipment storage room.
- 19 Evaporator Process Loop. The 242-A Evaporator process loop equipment components are as follows:
- 20 Reboiler (E-A-1)
- 21 Vapor-liquid separator (C-A-1)
- 22 Recirculation pump (P-B-1)
- 23 Recirculation loop.
- 24 Figure 4.2 is a simplified process flow diagram showing the major components of the process loop.
- 25 Reboiler (E-A-1). Waste is heated as the waste passes through the reboiler before entering the vapor-
- 26 liquid separator. The reboiler is a vertical tube unit with steam on the shell-side and process solution on
- 27 the tube-side. The 364 tubes in the reboiler are enclosed in a 1.03-meter outside diameter, 4.6-meter-long
- 28 stainless steel shell. Both the reboiler shell and tubes are constructed of 304L stainless steel. The shell is
- 29 0.64 centimeter thick and the tubes are 14-gauge steel. The reboiler is designed to distribute steam evenly
- 30 and to prevent tube damage from water droplets that may be present in the steam.
- 31 Vapor-Liquid Separator (C-A-1). Process solution from the reboiler enters the vapor-liquid separator
- 32 via the upper recirculation line. Some of the solution flashes into vapor, which exits through a vapor line
- 33 at the top of the vapor-liquid separator. The remaining solution (slurry) exits through the recirculation
- 34 line at the bottom.
- 35 The separator consists of a lower and upper section. The lower (liquid) section is a stainless steel shell
- 36 4.3 meters in diameter having an 85,200 to 94,600 liter normal operating capacity (including recirculation
- 37 loop and reboiler). The maximum design capacity is 103,000 liters. The upper (vapor) section is a
- 38 stainless steel shell 3.5 meters in diameter containing two deentrainment pads. These wire mesh pads
- 39 remove liquids and solids that entrain into the vapor section of the vessel. Spray nozzles, using recycled
- 40 process condensate or filtered raw water, wash collected solids from the deentrainment pads and vessel
- 41 walls. Both sections of the vapor-liquid separator are constructed of 0.95-centimeter-thick stainless steel.

- 1 Pressure in the vapor-liquid separator is monitored to provide an indication of process problems such as
- 2 slurry foaming, deentrainer flooding, or excessive vapor temperatures. Instrumentation also is available
- 3 to monitor the liquid levels in the vapor-liquid separator. Interlocks are activated when high pressures or
- 4 high- or low-liquid levels are detected, shutting down the evaporation process and placing the facility in a
- 5 safe configuration.
- 6 The vapor-liquid separator and recirculation loop can be flushed to remove any residual solids from the
- 7 system and/or to reduce radiation levels. The most common flush solution is water, but dilute nitric or
- 8 citric acid solutions could be used. All acidic flush solutions are chemically adjusted to meet DST
- 9 acceptance criteria before transfer to the DST System. The capability also exists to add an antifoam
- 10 solution (at very low flow rates approximately 0.04 to 0.4 liters per minute) to the vessel to prevent
- 11 foaming. The antifoam solution is a noncorrosive, nonregulated silicone-based solution that is compatible
- 12 with the evaporator components.
- 13 Recirculation Pump. The stainless steel recirculation pump (P-B-1), is constructed as part of the
- 14 recirculation loop to the reboiler. The 28-inch diameter axial flow pump has 60,900 liters per minute
- 15 output. The recirculation pump is designed to handle slurry up to 30 percent undissolved solids by
- 16 volume at specific gravities up to 1.8. The recirculation pump moves waste at high velocities through the
- 17 reboiler to improve heat transfer, keep solids in suspension, and reduce fouling of the heat transfer
- 18 surfaces.
- 19 The recirculation pump is equipped with shaft seals with high-pressure recycled process condensate (or
- 20 water) introduced between the seals to prevent the waste solution from leaking out of the system. Seal
- 21 water pressure and flow are monitored and controlled to shut down the recirculation pump if conditions
- 22 are not adequate to prevent waste liquid from migrating into the seal water. The used seal water is routed
- 23 to the feed tank.
- 24 Recirculation Loop. The recirculation loop consists of a 28-inch diameter stainless steel pipe that
- 25 connects the vapor-liquid separator to the recirculation pump and reboiler. The lower loop runs from the
- 26 bottom of the vapor-liquid separator to the recirculation pump inlet. The upper loop connects the pump
- 27 discharge to the reboiler and the reboiler to the vapor-liquid separator. The feed line from the feed tank
- 28 and the slurry line to underground storage tanks are connected to the upper recirculation line.
- 29 Slurry System. The slurry system draws a portion of the concentrated waste from the upper recirculation
- 30 loop and transfers it to the DST System. The major components of the slurry system are the slurry pump
- 31 and the slurry transfer pipelines. Figure 4.3 shows a simplified flow diagram of the slurry system. These
- 32 components are described in the following paragraphs.
- 33 The slurry pump (P-B-2) is used to transfer slurry from the recirculation loop to the underground storage
- 34 tanks. The pump is driven by a variable speed motor and is constructed of 304L stainless steel. The
- 35 slurry pump is designed to generate high pressures to alleviate the possibility of a transfer line plugging.
- 36 Interlocks control the operation of the slurry pump. The slurry pump (P-B-2) is shutdown if any of the
- 37 following occur:
- 38 Excessive pressure is detected in the slurry lines to 241-AW Tank Farm
- 39 A leak is detected in the secondary containment or cleanout boxes (COB) (COB-AW-1 and
- 40 COB-AW-2) located on the slurry transfer lines
- 41 A leak is detected in the 241-AW Tank Farm process pits where the transfer lines enter the
- 42 DST System.

- 1 The slurry pump uses a shaft seal with recycled process condensate (or water) and pressure and flow
- 2 controls similar to the system described above for the recirculation pump.
- 3 Transfer pipelines are 2-inch diameter, carbon steel encased lines which route slurry to a designated
- 4 underground DST within the 200 East Area. All transfer pipelines are encased in a secondary
- 5 containment pipe and equipped with leak detectors between the primary and encasement piping. The
- 6 pipelines are sloped to drain to the valve pit. The detection of any leak automatically shuts off the slurry
- 7 pump.
- 8 The flow rate of the slurry transfer to the DST System is monitored and a decrease in flow below a
- 9 specified value automatically will shut down the slurry pump (P-B-2) and initiate a line flush with water.
- 10 The objective of flushing the transfer line is to prevent settling of solids, which precludes plugging the
- 11 slurry transfer lines.
- 12 Samples can be taken from the slurry line when needed via a sampler (SAMP-F-2) that is located near the
- 13 feed sampler in the load out and hot equipment storage room.

### 14 4.1.3.1 Condensate Collection Tank (C-100) and Ancillary Equipment

- 15 The following section discusses the condensate collection tank (C-100) and ancillary equipment. This
- 16 equipment collects process condensate via the condensers in the vacuum condenser system, filters the
- 17 condensate, removes additional radionuclides, if necessary, and pumps the process condensate to LERF.
- 18 Figure 4.4 provides a simplified process flow diagram showing the major components of the process
- 19 condensate system. The following major components make up the process condensate system:
- 20 · Vacuum condenser system
- 21 Condensate collection tank (C-100)
- 22 Process condensate pump (P-C-100)
- 23 Condensate filters (F-C-1, F-C-2, and F-C-3)
- 24 D-1
- 25 Radiation monitoring and sampling system (RC-3)
- 26 Seal pot
- 27 Condensate Recycle System.
- 28 Vacuum Condenser System. Vapors removed from the vapor-liquid separator flow to a series of three
- 29 condensers where the vapors are condensed using raw water. Condensate drains to the condensate
- 30 collection tank (C-100). The vacuum condenser system consists of the following major components:
- 31 Primary condenser (E-C-1)
- 32 Intercondenser (E-C-2)
- 33 Aftercondenser (E-C-3)
- 34 Steam jet ejectors (J-EC1-1 and J-EC2-2).
- 35 Figure 4.5 provides a simplified process flow diagram showing the major components of the vacuum
- 36 condenser system. These system components are discussed in the following sections.
- 37 Primary Condenser (E-C-1). Vapors drawn from the vapor-liquid separator flow through the 42-inch
- 38 vapor line, into the E-C-1 condenser where the majority of the condensation takes place. Noncondensed
- 39 vapors exit to the intercondenser (E-C-2) while the condensed vapors (process condensate) drain to the
- 40 condensate collection tank (C-100). Cooling water passes through the cooling tubes and exits to TEDF.

- 1 The carbon steel condenser shell measures approximately 5.3 meters long and has a 2.2-meter inside
- 2 diameter. The condenser consists of 2,950 equally spaced carbon steel tubes that are 3.6 meters long with
- 3 a 1.9-centimeter outside diameter.
- 4 Intercondenser (E-C-2). Noncondensed vapors from E-C-1 enter the intercondenser. The vapor stream
- 5 contacts the cooling tubes in the condenser where cooling water provides additional condensation. The
- 6 condensate drains to the condensate collection tank (C-100). Noncondensed vapors and used cooling
- 7 water are routed to the aftercondenser.
- 8 The carbon steel intercondenser measures 2.2 meters long with a 0.39 meter inside diameter. This heat
- 9 exchanger contains 144 tubes that are 1.7 meters long with a 1.9-centimeter outside diameter.
- 10 Aftercondenser (E-C-3). Vapor discharged from the intercondenser enters the aftercondenser. Cooling
- 11 is supplied to the aftercondenser by the cooling water from the intercondenser. Condensate is routed to
- 12 the condensate collection tank (C-100), while the noncondensed vapors are filtered, monitored, and
- 13 discharged to the atmosphere through the vessel ventilation system. The cooling water is discharged to
- 14 TEDF.
- 15 The carbon steel aftercondenser measures 2.3 meters long and has a 0.20-meter inside diameter. This heat
- 16 exchanger contains 45 tubes that are 1.8 meters long with a 1.9-centimeter outside diameter.
- 17 Steam Jet Ejectors. The vacuum that draws the vapors from C-A-1 into the condensers is created by a
- 18 two-stage steam jet ejector system. The first-stage jet ejector (J-EC1-1) maintains a vacuum on the
- 19 primary condenser, which in turn creates a vacuum on the vapor-liquid separator. The ejector consists of
- 20 a steam jet, pressure controller, and air bleed-in valve. Steam and noncondensed vapors from the primary
- 21 condenser are ejected from J-EC1-1 into the intercondenser. The desired vacuum is obtained by
- 22 controlling steam pressure and bleeding ambient air as necessary into the vapor header through an air
- 23 intake filter. The second-stage jet ejector (J-EC2-1) creates the vacuum that moves vapors from the
- 24 intercondenser through the aftercondenser.
- 25 Condensate Collection Tank (C-100). Process condensate from the primary condenser, intercondenser,
- 26 aftercondenser, and the vessel ventilation system drain to the condensate collection tank (C-100). The
- 27 tank is 4.3 meters in diameter, 5.8 meters high, and is constructed of 0.79-centimeter-thick stainless steel.
- 28 The tank has a maximum design capacity of 67,400 liters. Normal operating volume is approximately
- 29 50 percent of the tank capacity. A carbon steel base supports the tank. An agitator is installed but not
- 30 used while pumping process condensate to LERF.
- 31 In the event of a tank overflow, the solution is routed through an overflow line to the drain system, which
- 32 returns waste to the feed tank (241-AW-102). Overflow occurs when the volume exceeds about
- 33 60,600 liters. The overflow line is equipped with a liquid filled trap to isolate the drain system from the
- 34 tank.
- 35 The potential exists for the condensate collection tank to receive small amounts of immiscible organics
- 36 with the condensed waste. There is instrumentation installed on the condensate collection tank to detect a
- 37 separate organic phase based on interface density at the surface of the waste in the tank. If detected, the
- 38 organic is removed by overflowing tank C-100 back to the feed tank 241-AW-102. In addition, the liquid
- 39 level in the tank is controlled well above the discharge pump intake point to ensure that an organic layer
- 40 cannot be pumped to LERF.
- 41 Process Condensate Pump. A pump (P-C-100) moves the process condensate from tank C-100 through
- 42 the condensate filter to LERF. The process condensate pump is a centrifugal pump constructed of 316
- 43 stainless steel.

- 1 Condensate Filters. After leaving the condensate collection tank, the process condensate is filtered to
- 2 remove solids. The primary condensate filter (F-C-1) has a welded steel housing. A second filter system
- 3 (F-C-3), installed downstream is also used to filter the process condensate. This system has duplex in-line
- 4 filters in cast iron housing. Only one of the filters is used at a time. Both filters employ a filter material
- 5 that is compatible with the process condensate.
- 6 Radiation Monitoring and Sampling. The process condensate transferred to LERF is monitored
- 7 continuously for radiation. If radiation levels exceed established limits, an alarm is received and
- 8 interlocks immediately divert the stream back to the condensate collection tank (or the feed tank) and shut
- 9 off the process condensate pump. This ensures process condensate containing excessive radionuclides
- 10 due to an accidental carryover from the vapor-liquid separator is not transferred to LERF.
- 11 Seal Pot. The condensate collection tank receives condensed liquids from the vessel ventilation system.
- 12 A seal pot collects the drainage before discharge into the condensate collection tank and isolates the tank
- 13 from the vessel ventilation system.
- 14 Condensate Recycle System. For waste minimization, a portion of the process condensate from tank
- 15 C-100 is recycled for use as decontamination solution for the deentrainment pad sprays and seal water for
- 16 the recirculation pump (P-B-1) and slurry pump (P-B-2). Use of process condensate instead of raw water
- 17 results in approximately 10 percent reduction in waste volume generated during continuous operation of
- 18 the 242-A Evaporator. Raw water also is available as a backup for sprays and seal water. A 2-inch
- 19 diameter carbon steel line, stainless steel centrifugal pump (P-C106), and filters (F-C-5 and F-C-6) supply
- 20 process condensate from tank C-100 to the pad sprays and pump seals. The filters are disposable
- 21 cartridge filters in carbon steel housings arranged in parallel with one filter in service while the other is in
- 22 standby.

#### 23 4.1.4 Integrity Assessments

- 24 The integrity assessment report (Attachment 35, Appendix 4B) discusses:
- 25 The standards used during design and construction of the 242-A Evaporator and the adequacy of
- 26 those standards
- 27 The characteristics of the DST waste processed
- 28 The adequacy of the materials of construction to provide corrosion protection from the waste
- 29 processed
- 30 The age of the tanks and the affect of age on tank integrity
- 31 The results of the leak tests, visual inspections, and tank wall thickness inspections
- 32 The frequency and scope of future integrity assessment
- 33 Deficiencies in secondary containment design. These deficiencies are discussed in Section 4.1.5.
- 34 The integrity assessment was certified by an independent, qualified registered professional engineer.
- 35 The inspections, tests, and analyses performed provide assurance that the 242-A Evaporator tank system
- 36 has adequate design, sufficient structural strength, and sufficient compatibility with the waste to not
- 37 collapse, rupture, or fail during operation. No evidence of degradation was noted during the visual test,
- 38 ultrasonic test, or leak test. Both condensate collection tank C-100 and the vapor-liquid separator/reboiler
- 39 loop passed leak tests. The frequency of subsequent integrity assessments will be established based on
- 40 the results of the last integrity assessment.

## 1 4.1.5 Additional Requirements for Existing Tanks

- 2 Refer to information in Section 4.1.2 and the integrity assessment report, which includes measuring tank
- 3 wall thicknesses, evaluating corrosion protection, and performing leak tests, have been discussed in.

## 4 4.1.6 Secondary Containment and Release Detection for Tank Systems

- 5 This section describes the design and operation of secondary containment sumps, drain lines, and leak
- 6 detection systems for the 242-A Evaporator.

## 7 4.1.6.1 Requirements for All Tank Systems

- 8 The Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100 (Vitro 1974)
- 9 was used during preparation, design, and construction of the tank and secondary containment systems.
- 10 The integrity assessment report details how the construction specification relates to the national codes and
- 11 standards.
- 12 Constructing the building and vessels per this specification ensures that foundations are capable of
- 13 supporting tank and secondary containment systems and that uneven settling and failures from pressure
- 14 gradients do not occur. The integrity assessment report states that the 242-A Evaporator has adequate
- 15 design, sufficient structural strength, and sufficient compatibility with the wastes to not collapse, rupture,
- 16 or fail during service loads associated with normal operations and that the building structure was designed
- 17 and constructed to withstand a design basis earthquake".
- 18 Section 2.2.7 of the integrity assessment report describes the building and secondary containment system.
- 19 This system is designed to ensure any release is detected within 24 hours. The secondary containment
- 20 system also is designed to contain 100 percent of the maximum operating capacity of the vapor-liquid
- 21 separator/reboiler loop, and the drain systems are sloped to allow collection of solution and have
- 22 sufficient capacity to drain this volume in less than the required 24 hours.
- 23 Section 2.2.7 of the integrity assessment report describes the protective coating material and sealant used
- 24 to protect concrete and joints from attack by leaks to the secondary containment. The materials of
- 25 construction for the sump and drain lines are also compatible with the waste processed at
- 26 the 242-A Evaporator.

### 27 4.1.6.2 242-A Building Secondary Containment

- 28 The 242-A Building serves as a secondary containment vault for the vapor-liquid separator (C-A-1),
- 29 condensate collection tank (C-100), and ancillary equipment used for transferring mixed waste at the
- 30 242-A Evaporator. The concrete for the operating area was poured to form a monolithic structure. Where
- 31 needed, joints in the concrete were fabricated with preformed filler conforming to the standards of the
- 32 American Society of Testing and Materials. Joint filler is sealed with a polysulfide sealant per the
- 33 requirements of the construction specifications (Vitro 1974).
- 34 Before restart in 1994, a new acrylic special protective coating was applied to the concrete in the pump,
- 35 evaporator, and condenser rooms. The coating meets the requirements of the construction specifications
- 36 (Vitro 1974), including resistance to very high radiations doses, temperatures of 77° C, and spills of
- 37 25 percent caustic solution.
- 38 The following five rooms contain equipment used to process mixed waste:
- 39 Pump room

- Evaporator room
- 2 Condenser room
- Load out and hot equipment storage room.

#### 4 4.1.6.2.1 Pump Room

- 5 The pump room secondary containment walls are 0.38- to 0.56-meter-thick reinforced concrete. The
- 6 secondary containment floor is 0.51-meter-thick reinforced concrete. The pump room floor is lined with
- 7 0.64-centimeter stainless steel and the concrete walls and ceiling cover blocks are painted with a special
- 8 protective coating. The pump room contains pipe jumpers used to transport feed and slurry solutions
- 9 between the vapor-liquid separator and the DST System, and the process recirculation loop, recirculation
- 10 pump (P-B-1), and slurry pump (P-B-2).
- 11 Leaks in the pump room collect in the pump room sump, a 1.5-meter by 1.5-meter by 1.8-meter deep
- 12 sump with a 0.64-centimeter stainless steel liner. The pump room sump collects spills from various
- 13 sources for transfer to the feed tank, 241-AW-102. Figure 4.6 provides a simplified process flow
- 14 schematic of sources, which drain to the pump room sump. Drainage to the sump includes:
- 15 Leaks to the pump room floor from equipment in the pump room
- 16 Evaporator room floor drain
- 17 Load out and hot equipment storage room floor drain
- Loading room floor drain
- 19 Decontamination room sump drains (including feed and slurry sampler drains)
- 20 Raw water backflow preventer drain.
- 21 Solution in the pump room sump is transferred to the feed tank (241-AW-102) using a steam jet.
- 22 A 10-inch secondary containment overflow line is provided for draining large volumes of solution should
- 23 a catastrophic tank failure occur. Because the overflow line provides a direct path between the air space
- 24 of tank 241-AW-102 and the pump room, a minimum level of water must be maintained in the sump to
- 25 prevent cross ventilation. A leak into the pump room sump would be detected by a rise in the sump level.
- 26 Instrumentation provided alarms on high sump level.
- 27 The recirculation and slurry pumps in the pump room are equipped with mechanical seals having
- 28 pressurized water introduced between the seals. The seal water is maintained at a pressure that exceeds
- 29 the process pressure at the seal to ensure water leaks into the process solution, but waste solution does not
- 30 leak out. Water from seal leakage is collected in funnels in the pump room and routed to feed
- 31 tank 241-AW-102 via the 10-inch overflow line described previously.

#### 32 **4.1.6.2.2** Evaporator Room

- 33 The evaporator room secondary containment walls are 0.56-meter-thick reinforced concrete. The
- 34 secondary containment floor is 0.51-meter-thick reinforced concrete. The evaporator room contains the
- 35 vapor-liquid separator vessel (C-A-1), part of the recirculation loop, the reboiler, the 42-inch vapor line,
- 36 and line used to empty the vapor-liquid separator to feed tank 241-AW-102.
- 37 Leaks in the evaporator room flow to a floor drain that routes through a 3-inch line to the pump room
- 38 sump described in Section 4.1.4.2.1. A leak in the evaporator room would be detected by a rise in the
- 39 pump room sump level. The floor of the evaporator room and a portion of the pump room floor are
- 40 3.0 meters below grade to contain the entire contents of the vapor-liquid separator, reboiler, and
- 41 recirculation loop in the event of a catastrophic failure. The floor and walls of the evaporator room up to
- 42 an elevation of 1.8 meters are painted with a special protective coating.

#### 1 **4.1.6.2.3** Condenser Room

- 2 The condenser room secondary containment walls are 0.36- to 0.56-meter-thick reinforced concrete. The
- 3 secondary containment floor is 0.51-meter-thick reinforced concrete. The condenser room contains all
- 4 the components of the process condensate system described in Section 4.1.1.2, including tank C-100.
- 5 Leaks in the condenser room flow to two floor drains that join and route through a 6-inch line to feed tank
- 6 241-AW-102. Leaks in the condenser room are detected by the following:
- 7 Unexpected changes in liquid level in tank C-100. Instrumentation is provided to monitor liquid level
- 8 in the tank, including high- and low-level alarms.
- Daily visual inspections of process condensate system components and piping.
- 10 The floor and walls of the condenser room up to an elevation of 1.2 meters are painted with a special
- 11 protective coating.

#### 12 4.1.6.2.4 Load out and Hot Equipment Storage Room

- 13 The load out and hot equipment storage room secondary containment walls are 0.30- to 0.56-meter-thick
- 14 reinforced concrete. The secondary containment floor is 0.15-meter-thick reinforced concrete. The room
- 15 contains two recirculation lines and samplers used to sample the feed and slurry streams. The lines and
- 16 samplers are located in a shielded enclosure adjacent to the pump room wall.
- 17 The load out and hot equipment storage room contains two sumps: the drain sump and decontamination
- 18 sump. The sumps are 0.91 meter in diameter, about 1.2 meters deep, and lined with stainless steel. Both
- 19 sumps drain via a 3-inch drain line to the pump room sump described in Section 4.1.4.2.1. The sumps,
- 20 floor, and walls of the load out and hot equipment storage room up to an elevation of 3.8 meters are
- 21 painted with a special protective coating.
- 22 Leaks in the sampler piping, flow into two drains in the sample enclosure, which drain via a 2-inch line to
- 23 the decontamination sump, which drains to the pump room sump (described in 4.1.4.2.1). Leaks in the
- 24 sampler piping are detected by leak detectors in the sampler enclosures or a rise in the pump room sump
- 25 level.

### 26 4.1.6.2.5 242-A Building Drain Lines

- 27 Figure 4.6 provides a simplified process flow schematic of sources routed to the 242-A Building drain
- 28 lines. Three lines serve to drain the 242-A Building and equipment to feed tank 241-AW-102:
- 29 Pump room sump drain line (DR-334): a 10-inch carbon steel line that transfers overflow and
- 30 empty-out of the pump room sump
- 31 Vapor-liquid separator vessel drain line (DR-335): a 10-inch carbon steel line that allows gravity
- drain of the vessel to the feed tank
- 33 Condenser room drain line (DR-343): a 6-inch carbon steel line that drains leakage from the
- 34 condenser room.
- 35 The three lines are sloped to drain about 170 meters to feed tank 241-AW-102 via the drain pit
- 36 (241-AW-02D). Although WAC 173-303-640(1)(c) exempts systems that serve as secondary
- 37 containment from requiring secondary containment, drain lines DR-334, DR-335, and DR-338 have
- 38 outer encasement piping.

- 1 The drain lines are connected to a cathodic protection system to prevent external corrosion from contact
- 2 with the soil. The cathodic protection system consists of:
- A rectifier that converts supplied alternating current voltage to an adjustable direct current voltage
- 4 Numerous anodes buried near the underground piping and connected to the rectifier.
- 5 Return wiring that connects the piping to the rectifier, completing the circuit.
- 6 The rectifiers are inspected to component degradation has not occurred. Test stations along the system
- are checked annually to verify 0.85 volt is maintained on the system, as required by the National
- Association of Corrosion Engineers. These inspections are discussed in Attachment 35, Chapter 6.0.

#### 9 4.1.6.3 Transfer Line Containment

- 10 This section describes the design and operation of secondary containment and leak detection systems for
- 11 transfer lines between the DST System and the 242-A Evaporator. The transfer line for process
- 12 condensate to LERF also has secondary containment and a leak detection system. The transfer lines are
- 13 protected with the same cathodic protection system described in Section 4.1.4.2.6.

#### 14 4.1.6.3.1 Feed Line Piping

- 15 Two feed lines (SN-269 and SN-270) (one in service and one spare), each consist of 3-inch transfer
- 16 piping within a 6-inch secondary containment encasement piping. Both the transfer and encasement pipes
- 17 are constructed of Schedule 40 carbon steel. The lines run below grade about 120 meters from pump pit
- 18 241-AW-02E (above feed tank 241-AW-102) to the 242-A Building.
- 19 To detect transfer-piping failures, leak detector risers equipped with conductivity probes are installed on
- 20 the encasement lines. The transfer piping and encasements are sloped towards the conductivity probe,
- 21 which, on leak detection, annunciates an alarm in the 242-A Evaporator control room. A valve in the
- 22 pump pit (241-AW-02E) can be opened to drain solution from the encasement pipe into the pit, which
- 23 drains to feed tank 241-AW-102.

#### 24 **4.1.6.3.2** Slurry Line Piping

- 25 The slurry pump (P-B-2) transfers solution through one of two transfer lines: SL-167, for transfer to
- 26 valve pit 241-AW-B (standard configuration), or SL-168 for transfer to valve pit 241-AW-A (alternate
- 27 configuration, presently out of service). Slurry solution can be routed via double-encased piping from
- 28 these valve pits to any designated DST slurry receiver. Both slurry transfer lines consist of 2-inch
- 29 transfer piping within a 4-inch secondary containment encasement piping. Both the transfer and
- encasement pipes are constructed of Schedule 40 carbon steel. The lines run below grade about 73 meters
- 31 between the 242-A Building and the valve pits.
- 32 These slurry lines contain leak detector risers and conductivity probes similar to the feed line piping
- 33 described in Section 4.1.4.3.1.
- 34 Each slurry line has four COBs located along their length. The COBs were installed to allow the
- 35 introduction of a 'water snake' to dislodge plugs in the slurry line. Because of difficulties encountered in
- 36 there use and the low frequency with which plugging occurs, the COBs are no longer used; however, the
- 37 COBs still form part of the primary containment for the slurry transfer lines. Each COB has three 1-inch
- 38 carbon steel lines. Two lines are connected to the slurry line for cleanout, while a third line, connects via
- 39 a 2-inch encasement pipe to the feed transfer line for drainage. The three lines extend to sealed flanges at
- ground level.

- 1 Secondary containment for each COB is provided by a 0.63-centimeter-thick carbon steel plate caisson
- 2 (measuring 0.6 meter in diameter and 0.6 meter high) mounted on a 0.3-meter diameter carbon steel riser.
- 3 Each caisson has a flange cover and vent line to prevent pressure buildup in the secondary confinement
- 4 air space.
- 5 To drain liquids that might collect in the COB secondary containment, a 1-inch diameter floor drain line
- 6 and valve are provided. When the drain valve is opened, solution in the COB drains to the slurry line
- 7 secondary containment encasement piping. Leaks are detected by a conductivity probe mounted to the
- 8 floor of the COB, which annunciates in the 242-A Evaporator control room.

## 9 4.1.6.4 Additional Requirements for Specific Types of Systems

- 10 This section addresses additional requirements in WAC 173-303-640 for vault systems like the
- 11 242-A Building to ensure no buildup of ignitable vapors nor does infiltration of precipitation occur. This
- 12 section also addresses secondary containment for ancillary equipment and piping associated with the tank
- 13 systems.

### 14 4.1.6.4.1 Vault Systems

- 15 The 242-A Building is a vault constructed partially below ground, providing secondary containment for
- 16 the tank systems. The DST System waste processed at the 242-A Evaporator is designated ignitable and
- 17 reactive because of the presence of nitrite and nitrate salts, which are considered oxidizers per
- 18 49 CFR 173. Because of their low volatility, these compounds are unlikely to be present in the vapor
- 19 phase of the tank systems at the 242-A Evaporator. However, to prevent the spread of contamination, the
- 20 vapor-liquid separator (C-A-1) is ventilated and maintained at lower air pressure than the building air
- 21 space. This ensures air leakage is from uncontaminated building air space into the tank vapor space.
- 22 Vapors from the vapor-liquid separator flow to the vacuum condenser system described in
- 23 Section 4.1.1.2.
- 24 The condensate collection tank (C-100), collects process condensate that is not designated ignitable or
- 25 reactive.
- 26 The tank systems and ancillary equipment are located within the 242-A Building, which is completely
- 27 enclosed to prevent run-on and infiltration of precipitation into the secondary containment system.

#### 28 4.1.6.4.2 Ancillary Equipment

- 29 The 242-A Building provides secondary containment for ancillary equipment. Double containment is
- 30 provided for the feed and slurry transfer lines between the 242-A Building and the AW Tank Farm by
- 31 pipe-in-pipe arrangements. Therefore, all ancillary equipment has secondary containment and the daily
- 32 inspection requirements in WAC 173-303-640(4)(f) are not applicable.

## 33 4.1.7 Variances from Secondary Containment Requirements

- 34 Section 7.2 of the integrity assessment report discusses the following three deficiencies associated with
- 35 the secondary containment system:
- 36 Pump Room Sump. The pump room sump does not comply with secondary containment requirements
- 37 because liquid must be kept in the sump to provide a seal to prevent airflow between the pump room and
- 38 feed tank 241-AW-102. Although the sump has a 0.63-centimeter-thick stainless steel liner to prevent
- 39 corrosion of the concrete floor, the sump does not have secondary containment.

- Routine Discharges through Secondary Containment. The configuration of the 242-A Evaporator
- 2 process requires routine, batch discharges of dangerous waste through secondary containment drain lines.
- 3 These routine discharges include the following.
- 4 Steam condensate, cooling water, and process condensate sample stations drain to the feed tank,
- 5 241-AW-102, through drain line DR-343. Total discharge is about 38 liters per month during
- 6 operation.
- 7 Sample bottle water sprays down in the feed and slurry sample stations drain to the decontamination
- 8 sump in the load out and hot equipment storage room. The decontamination sump then drains to the
- 9 pump room sump. Total discharge is about 76 liters per month during operation.
- 10 Transfer Piping Wall Penetrations. Three dangerous waste transfer line piping sections passing
- 11 through the 242-A Building wall are single-walled, i.e., no secondary confinement in the wall (about
- 12 56-centimeter-thick reinforced concrete).
- 13 These deficiencies were identified to Ecology, October 28, 1993. Ecology's response stated, "No physical
- 14 revision of the pipe wall penetrations or the floor drains in the evaporator pump room will be required
- 15 prior to evaporator restart." The response required the following.
- 16 If at any time leakage is seen or detected from either of these installations, or if for any reason these
- installations are repaired or rebuilt, they will be rebuilt or repaired in accordance with regulations.
- 18 Should a spill occur in the evaporator pump room, the sump and the piping shall be rinsed three times
- as required in WAC 173-303-160 as appropriate. 'Appropriate' in this case means that the original
- 20 regulation was written for a free container, not a sump, so that judgment will have to be used in the
- 21 application of the regulation. The rinsate shall be transferred to the double-shell tanks.

#### 22 4.1.8 Tank Management Practices

- 23 All waste to be processed at the 242-A Evaporator must be sampled to determine if the waste is
- 24 compatible with the materials of construction at the 242-A Evaporator. Before each campaign, candidate
- 25 feed tanks are sampled per the requirements of the waste analysis plan (Attachment 35, Chapter 3.0).
- 26 Based on the results, three possible options are implemented.
- 27 The waste is acceptable for processing without further actions.
- 28 The waste is unacceptable for processing as a single batch, but is acceptable if blended with other
- waste that is going to be processed.
- 30 The waste is unacceptable for processing.
- 31 The 242-A Evaporator process is controlled by the MCS. The MCS computer monitors liquid levels in
- 32 the vapor-liquid separator (C-A-1) and condensate collection tank (C-100) and has alarms that annunciate
- 33 on high-liquid level to notify operators that actions must be taken to prevent overfilling of these vessels.
- 34 An interlock is activated when high-liquid level in the vapor-liquid separator (C-A-1) is detected,
- 35 automatically shutting down the feed transfer pump at feed tank 241-AW-102, thereby preventing
- 36 overfilling of the vessel and carryover of slurry into the process condensate system. The condensate
- 37 collection tank (C-100) has an overflow line that routes solution to feed tank 241-AW-102 in case of
- 38 overfilling.
- 39 Process and instrumentation drawings are listed in Section 4.3.

## 1 4.1.9 Labels or Signs

- 2 A labeling upgrade was completed before restart in 1994 for tank C-100 to identify the waste contents and
- 3 major risks associated with waste stored within the tank. Tank C-100 ancillary piping is labeled
- 4 "PROCESS CONDENSATE" to alert trained personnel which pipes in the condenser room contain
- 5 dangerous waste. The vapor-liquid separator (C-A-1) is located in the evaporator room, a normally
- 6 unoccupied area. This area is posted as a high radiation area with ALARA access controlled and limited
- 7 to trained personnel only. The tank labels are visible from the walls of the tank enclosure rooms, which
- 8 are less than 15 meters from the tank systems; therefore, label visibility requirements are met.

#### 9 4.1.10 Air Emissions

- 10 Tank systems that contain extremely hazardous waste, and is acutely toxic by inhalation must be designed
- 11 to prevent the escape of such vapors. The DST System waste in the vapor-liquid separator, C-A-1, is
- 12 designated extremely hazardous waste; however, no determination has been performed to determine if the
- 13 waste is acutely or chronically toxic. Most of the toxic compounds in the DST waste are not volatile, but
- 14 because of the high radioactivity of the waste, controls are included to prevent or mitigate the release of
- 15 tank vapors. The vapor-liquid separator is maintained under vacuum to ensure air leakage is from
- 16 uncontaminated building air space into the tank vapor space. The boiling vapor in C-A-1 passes through
- 17 deentrainment pads and sprays to prevent liquid and solid carryover into the vapor section of the tank.
- 18 The vapor stream passes through three condensers that remove the condensable components. The
- 19 noncondensable vapors pass through HEPA filters before being discharged to the environment.

## 20 4.1.11 Management of Ignitable or Reactive Wastes in Tank Systems

- 21 Although the DST System waste reprocessed at the 242-A Evaporator is designated ignitable because of
- 22 the presence of oxidizers (nitrates and nitrites), the waste does not meet the definition of a combustible or
- 23 flammable liquid given in National Fire Protection Association (NFPA) code number 30 (NFPA 1996).
- 24 The buffer zone requirements in NFPA-30, which require tanks containing combustible or flammable
- 25 solutions be a safe distance from each other and from public way, are not applicable.
- 26 An analysis is performed on the DST System waste to be processed to verify the waste does not react
- 27 exothermically at the elevated temperatures at the 242-A Evaporator. The waste analysis plan
- 28 (Attachment 35, Chapter 3.0) discusses waste acceptance requirements due to reactive waste designation.

## 29 4.1.12 Management of Incompatible Wastes in Tank Systems

- 30 Waste transferred to the 242-A Evaporator must be compatible before mixing. The waste analysis plan
- 31 (Attachment 35, Chapter 3.0) includes waste compatibility requirements.

#### 32 4.2 AIR EMISSIONS CONTROL

- 33 This section addresses the requirements of Air Emission Standards for Process Vents, under Subpart AA
- 34 (incorporated by reference in WAC 173-303-690).

# 35 4.2.1 Applicability of Subpart AA Standards

- 36 The 242-A Evaporator performs distillation that specifically requires evaluation of process vents for the
- 37 applicability of 40 CFR 264 Subpart AA.

- 1 Waste processed at the 242-A Evaporator routinely contains greater than 10 parts per million organic
- 2 concentrations; therefore, organic air emissions are subject to 40 CFR 264.1032, which requires organic
- 3 emissions from all affected vents at the Hanford Facility be less than 1.4 kilograms per hour and
- 4 2.8 megagrams per year, or control devices be installed to reduce organic emissions by 95%.
- 5 The 242-A Evaporator has one process ventilation system that vents both the vapor-liquid
- 6 separator (C-A-1) and the condensate collection tank (C-100). The vent lines from both tanks combine
- 7 before entering an off-gas system consisting of a deentrainer, a prefilter/demister, HEPA filters, and an
- 8 exhaust fan. The vessel vent off-gas system is located on the third floor of the condenser room, with the
- 9 exhaust stack extending horizontally through the east wall of the building at an elevation of 14.7 meters
- 10 above ground level. The exhaust stack bends to run vertically with the discharge point 18.6 meters above
- 11 ground level.
- 12 The annual average flow rate for the vessel vent is given in Radionuclide Air Emissions Report for the
- 13 Hanford Site Calendar Year 1995 (DOE-RL 1996) as 18 cubic meters per minute and the total annual
- 14 flow was 9.6 E+06 cubic meters. During waste processing, the airflow is about 20.5 cubic meters per
- 15 minute, with about 4.3 cubic meters per minute ventilated from tank C-100 and the remainder from the
- 16 vapor-liquid separator and air in leakage.
- 17 Organic emissions occur during waste processing, which is less than 6 months (182 days) each year. This
- 18 is the maximum annual operating time for the 242-A Evaporator, as shutdowns are required during the
- 19 year for maintenance outages, candidate feed tank analysis, and establishing transfer routes for staging
- 20 waste in the DST System. The total operating time for the two campaigns in 1994 was 86 days.

## 21 4.2.2 Process Vents - Demonstrating Compliance

- 22 This section outlines how the 242-A Evaporator complies with the requirements of 40 CFR 264,
- 23 Subpart AA, including a discussion of the basis for meeting the organic emission limits, calculations
- 24 demonstrating compliance, and conditions for reevaluating compliance.

#### 25 4.2.2.1 Basis for Meeting Limits/Reductions

- 26 The TSD units at the Hanford Facility subject to 40 CFR 264, Subpart AA meet the organic air emission
- 27 limits of 1.4 kilograms per hour and 2.8 megagrams per year, established in 40 CFR 264.1032, by the
- 28 design of the facility. The 242-A Evaporator and the other TSD units collectively can meet these
- 29 standards without the use of air pollution control devices.

#### 30 4.2.2.2 Demonstrating Compliance

- 31 Process vent organic air emissions are controlled by establishing limits for acceptance of waste at the
- 32 242-A Evaporator. Before startup of each campaign, the waste to be processed is sampled in the DST
- 33 System to determine the organic content. If the concentrations of organic constituents are less than the
- 34 limits in the waste analysis plan (Attachment 35, Chapter 3.0), the waste can be processed, provided the
- 35 Hanford Facility will not exceed 1.4 kilograms per hour and 2.8 megagrams per year. The waste
- 36 acceptance limits in the waste analysis plan are based on equilibrium calculations and assumptions given
- 37 in Organic Emission Calculations for the 242-A Evaporator Vessel Vent System (WHC 1996). The
- 38 calculation to determine organic emissions consists of the following steps:
- Determine the emission rate of each candidate feed tank organic constituent by multiplying the
- 40 constituent concentration by the corresponding partition factor in Organic Emission Calculations for
- 41 the 242-A Evaporator Vessel Vent System (WHC 1996).

- 1 2. Sum the emission rates of all organic constituents to determine the emission rate for the candidate
- 2 feed tank. The maximum emission rate for the campaign is the rate from the candidate tank with the
- 3 greatest emission rate.
- 4 3. Determine the total amount of emission during the campaign by using operating time and a weighted average emission rate, based on the volume of each candidate feed tank processed.
- 6 The organic emission rates and quantity of organics emitted during the campaign are determined using
- 7 these calculations and are included in the operating record for each campaign, as required by
- 8 40 CFR 264.1035. The Hanford Facility has a system to ensure organic emissions from units subject to
- 9 40 CFR 264, Subpart AA are less than the limits of 1.4 kilograms per hour and 2.8 megagrams per year.
- 10 Records documenting total organic emissions are available for Ecology review on request.

## 11 4.2.2.3 Reevaluating Compliance with Subpart AA Standards

- 12 Calculations to determine compliance with Subpart AA will be reviewed when any of the following
- 13 conditions occur at the 242-A Evaporator:
- 14 Changes in the configuration or operation that affect the assumptions in the Organic Emission
- 15 Calculations for the 242-A Evaporator Vessel Vent System (WHC 1996).
- 16 Annual operating time exceeds 182 days.

#### 17 4.3 ENGINEERING DRAWINGS

- 18 The drawings in Table 4.2 are process and instrumentation diagrams for the systems at the
- 19 242-A Evaporator that contact mixed waste. These drawings are provided for general information and to
- 20 demonstrate the adequacy of the design of the tank systems.

21 Table 4.1. Process and Instrumentation Diagrams.

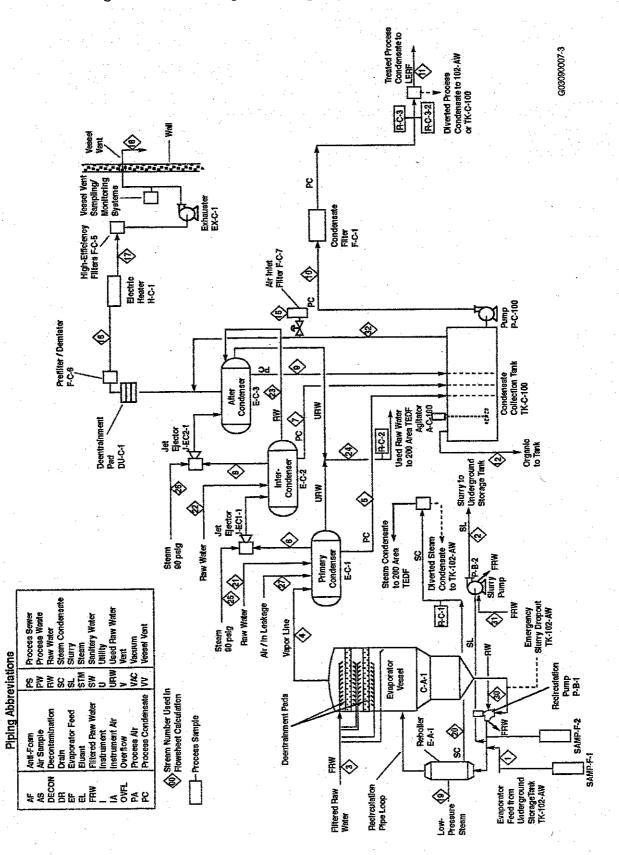
System	Drawing Number	Drawing Title
Vapor-Liquid Separator	H-2-98988 Sheet 1	P & ID Evaporator Recirc System
Reboiler/Recirculation Line	H-2-98988 Sheet 2	P & ID Evaporator Recirc System
Slurry System	H-2-98989 Sheet 1	P & ID Slurry System
Condensate Collection Tank	H-2-98990 Sheet 1	P & ID Process Condensate System
Secondary Containment Drain System	H-2-98995 Sheet 1	P & ID Drain System
Secondary Containment Drain System	H-2-98995 Sheet 2	P & ID Drain System
Condensers	H-2-98999 Sheet 1	P & ID Vacuum Condenser System
Pump Room Sump	H-2-99002 Sheet 1	P & ID Jet Gang Valve System
Condensate Recycle System	H-2-99003 Sheet 1	P & ID Filtered Raw Water System

- 22 The drawings in Table 4.3 are for secondary containment systems for the 242-A Evaporator. Because
- 23 secondary containment systems are the final barrier for preventing the release of dangerous waste into the
- 24 environment, modifications that affect the secondary containment systems will be submitted to the
- 25 Washington State Department of Ecology, as a Class 1, 2, or 3 permit modification, as required by
- 26 WAC 173-303-830.

Table 4.2. Drawings of 242-A Evaporator Secondary Containment Systems.

System	Drawing Number	Drawing Title
242-A Building	H-2-69277 Sheet 1	Structural Foundation Plan Sections & General Notes - Areas 1 & 2
	H-2-69278 Sheet 1	Structural Foundation Elevations & Details - Areas 1 & 2
	H-2-69279 Sheet 1	Structural First Floor Plan & AMU - Areas 1 & 2
Pump Room Sump Drainage	H-2-69352 Sheet 1	Sections Process Waste Drainage
242-A Building Drainage	H-2-69354 Sheet 1	Plan Process Waste Drainage
Pump Room Sump	H-2-69369 Sheet 1	Pump Room Sump Assembly & Details

Figure 4.1. 242-A Evaporator Simplified Process Flow Diagram.



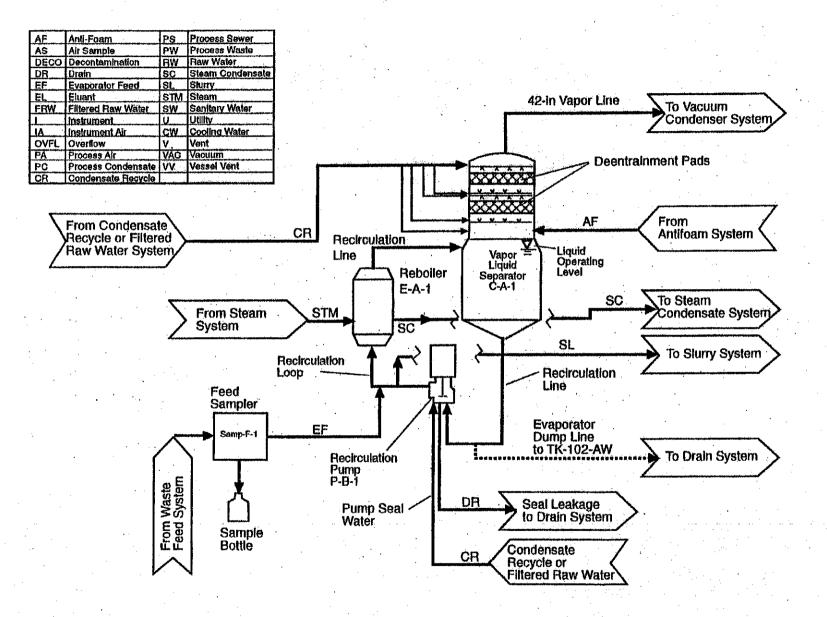


Figure 4.2. 242-A Evaporator Process Loop.

Figure 4.3. 242-A Evaporator Slurry System.

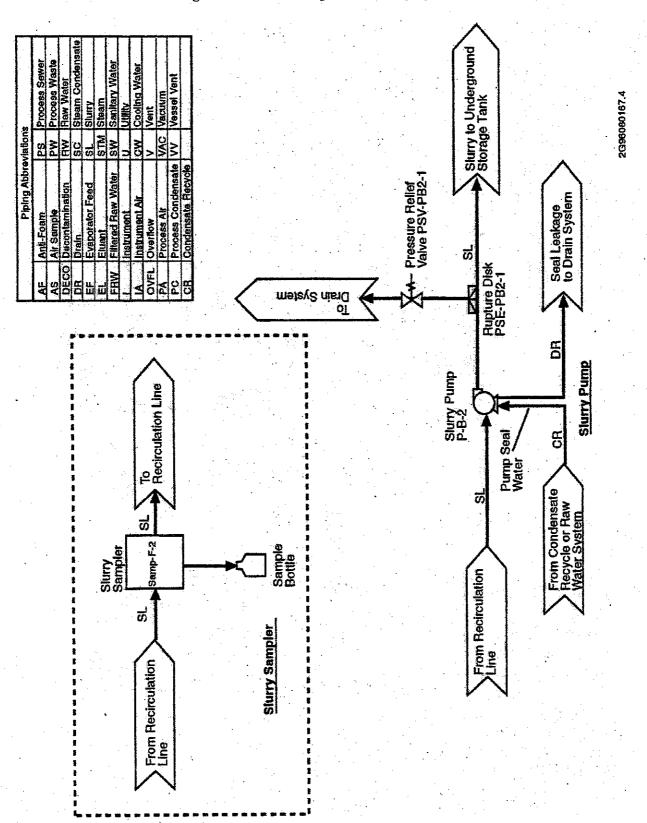


Figure 4.4. 242-A Evaporator Process Condensate System.

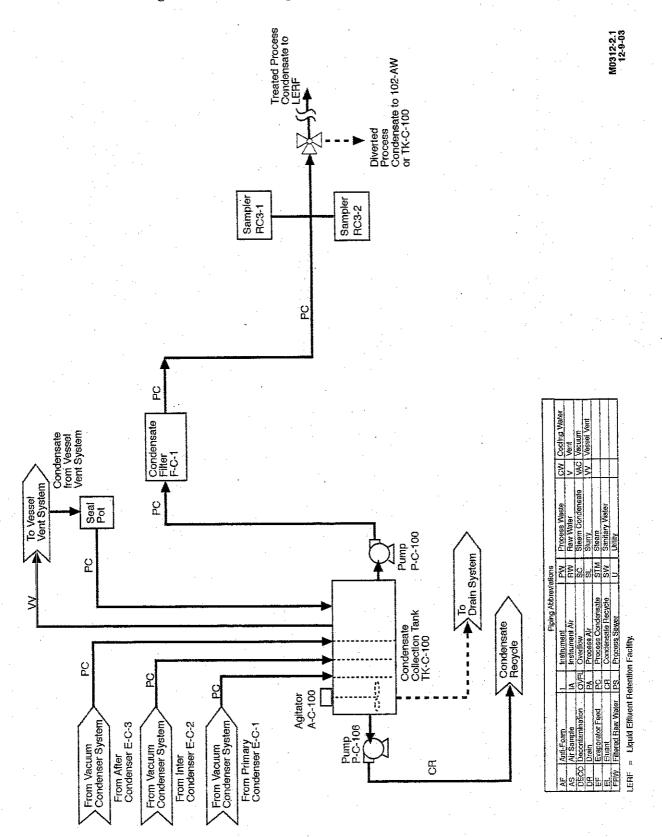


Figure 4.5. 242-A Evaporator Vacuum Condenser System.

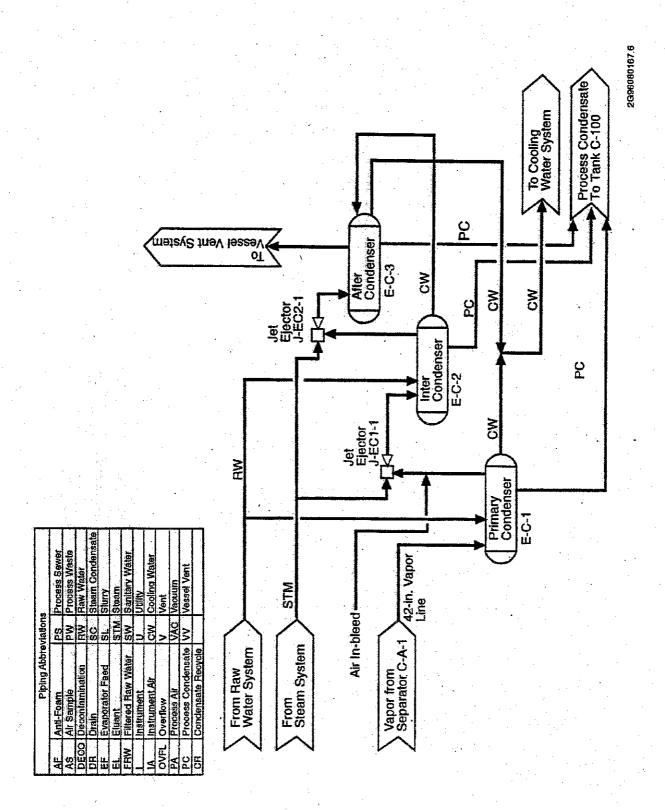
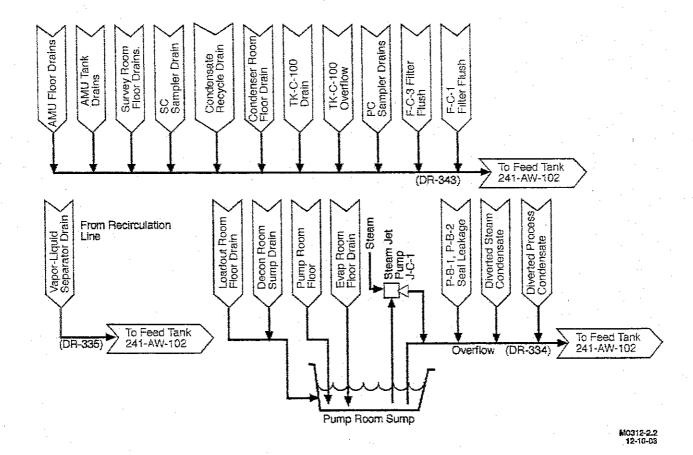


Figure 4.6. 242-A Evaporator Drain System



WA7890008967, Attachment 35 242-A Evaporator

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Class 1 Mod	ification:
Quarter Endi	ng 12/31/2003

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#### 8.0 PERSONNEL TRAINING

- This chapter discusses personnel training requirements based on WAC 173-303 and the HF RCRA Permit 2
- 3 (DW Portion). In accordance with WAC 173-303-806(4)(a)(xii), the Hanford Facility Dangerous Waste
- 4 Part B Permit Application must contain two items: (1) "an outline of both the introductory and
- 5 continuing training programs by owners or operators to prepare persons to operate or maintain the TSD
- facility in a safe manner as required to demonstrate compliance with WAC 173-303-330" and (2) "a brief 6
- description of how training will be designed to meet actual job tasks in accordance with the requirements 7
- 8 in WAC 173-303-330(1)(d)." The HF RCRA Permit, (DW portion) Condition II.C (Personnel Training)
- contains training requirements applicable to Hanford Facility personnel and non-Facility personnel. 9
- 10 Compliance with these requirements at the 242-A Evaporator is demonstrated by information contained
- 11 both in the Hanford Facility RCRA Permit, Attachment 33, Chapter 8.0 (DOE/RL-91-28) and this
- 12 chapter. This chapter supplements Attachment 33, Chapter 8.0 (DOE/RL-91-28).

#### 13 8.1 **OUTLINE OF INTRODUCTORY AND CONTINUING TRAINING PROGRAMS**

- 14 The introductory and continuing training programs are designed to prepare personnel to manage and
- 15 maintain the TSD unit in a safe, effective, and environmentally sound manner. In addition to preparing
- 16 personnel to manage and maintain TSD units under normal conditions, the training programs ensure that
- 17 personnel are prepared to respond in a prompt and effective manner should abnormal or emergency
- 18 conditions occur. Emergency response training is consistent with the description of actions contained in
- 19 Attachment 35, Chapter 7.0, Contingency Plan. The introductory and continuing training programs
- 20 contain the following objectives:
- 21 Teach Hanford Facility personnel to perform their duties in a way that ensures the Hanford Facility's 22 compliance with WAC 173-303
- 23 Teach Hanford Facility personnel dangerous waste management procedures (including
- 24 implementation of the contingency plan) relevant to the job titles/positions in which they are
- 25 employed, and
- 26 Ensure Hanford Facility personnel can respond effectively to emergencies.

#### 27 8.1.1 **Introductory Training**

- 28 Introductory training includes general Hanford Facility training and TSD unit-specific training. General
- 29 Hanford Facility training is described in Attachment 33, Chapter 8.0, Section 8.1 (DOE/RL-91-28), and is
- 30 provided in accordance with the HF RCRA Permit (DW Portion), Condition II.C.2. TSD unit-specific
- 31 training is provided to Hanford Facility personnel, allowing those personnel to work unescorted, and in
- 32 some cases is required for escorted access. Hanford Facility personnel cannot perform a task for which
- 33 they are not properly trained, except to gain required experience while under the direct supervision of a
- supervisor or coworker who is properly trained. Hanford Facility personnel must be trained within 6 34
- 35 months after their employment at or assignment to the Hanford Facility, or to a new job title/position at
- 36 the Hanford Facility, whichever is later.
- General Hanford Facility training: Refer to description in Attachment 33, Chapter 8.0, Section 8.1 37
- 38 (DOE/RL-91-28).
- 39 Contingency Plan training: Hanford Facility personnel receive training on applicable portions of the
- 40 Hanford Emergency Management Plan [Attachment 4 of the HF RCRA Permit (DW Portion)] in general
- 41 Hanford Facility training. In addition, Hanford Facility personnel receive training on content of the

- description of actions contained in contingency plan documentation in Attachment 35, Chapter 7.0 to be
- 2 able to effectively respond to emergencies.
- 3 Emergency Coordinator training: Hanford Facility personnel who perform emergency coordinator duties
- 4 in WAC 173-303-360 (e.g., Building Emergency Director) in the Hanford Incident Command System
- 5 receive training on implementation of the contingency plan and fulfilling the position within the Hanford
- 6 Incident Command System. These Hanford Facility personnel must also become thoroughly familiar
- with applicable contingency plan documentation, operations, activities, location, and properties of all
- 8 waste handled, location of all records, and the unit/building layout.
- 9 Operations training: Dangerous waste management operations training (e.g., waste designation training,
- shippers training) is determined on a unit-by-unit basis and considers the type of waste management unit
- 11 (e.g., container management unit) and the type of activities performed at the waste management unit
- 12 (e.g., sampling). For example, training provided for management of dangerous waste in containers is
- different than the training provided for management of dangerous waste in a tank system. Common
- 14 training required for compliance within similar waste management units can be provided in general
- training and supplemented at the TSD unit. Training provided for TSD unit-specific operations is
- identified in the training plan documentation based on: (1) whether a general training course exists,
- 17 (2) the training needs to ensure waste management unit compliance with WAC 173-303, and (3) training
- 18 commitments agreed to with Ecology.

## 19 8.1.2 Continuing Training

- 20 Continuing training meets the requirements for WAC 173-303-330(1)(b) and includes general Hanford
- 21 Facility training and TSD unit-specific training.
- 22 General Hanford Facility training: Annual refresher training is provided for general Hanford Facility
- training. Refer to description in Attachment 33, Chapter 8.0, Section 8.1 (DOE/RL-91-28).
- 24 Contingency plan training: Annual refresher training is provided for contingency plan training. Refer to
- description above in Section 8.1.1.
- 26 Emergency coordinator training: Annual refresher training is provided for emergency coordinator
- training. Refer to description above in Section 8.1.1.
- 28 Operations training: Refresher training occurs on many frequencies (i.e., annual, every other year, every
- 3 years) for operations training. When justified, some training will not contain a refresher course and will
- 30 be identified as a one-time only training course. The TSD unit-specific training plan documentation will
- 31 specify the frequency for each training course. Refer to description above in Section 8.1.1.

## 32 8.2 DESCRIPTION OF TRAINING DESIGN

- 33 Proper design of a training program ensures personnel who perform duties on the Hanford Facility related
- to WAC 173-303-330(1)(d) are trained to perform their duties in compliance with WAC 173-303. Actual
- 35 job tasks, referred to as duties, are used to determine training requirements. The first step taken to ensure
- 36 Hanford Facility personnel have received the proper training is to determine and document the waste
- management duties by job title/position. The second step compares waste management duties to general
- 38 waste management unit training curriculum. If general waste management unit training curriculum does
- 39 not address the waste management duties, the training curriculum is supplemented and/or on-the-job
- 40 training is provided. The third step summarizes the content of a training course necessary to ensure that
- 41 the training provided to each job title/position addresses associated waste management duties. The last

- step is to assign training curriculum to Hanford Facility personnel based on the previous evaluation. The
- 2 training plan documentation contains this process.
- 3 Waste management duties include those specified in Section 8.1 as well as those contained in
- 4 WAC 173-303-330(1)(d). Training elements of WAC 173-303-330(1)(d) applicable to the
- 5 242-A Evaporator operations include the following:
- 6 Procedures for using, inspecting, repairing, and replacing emergency and monitoring equipment
- 7 Key parameters for automatic waste feed cut-off systems
- 8 Communications or alarm systems
- 9 Response to fires or explosions
- Shutdown of operations.
- 11 Hanford Facility personnel who perform these duties receive training pertaining to their duties. The
- training plan documentation described in Section 8.3 contains specific information regarding the types of
- training Hanford Facility personnel receive based on the outline in Section 8.1.

#### 14 8.3 DESCRIPTION OF TRAINING PLAN

- 15 In accordance with HF RCRA Permit (DW Portion), Condition II.C.3, the unit-specific portion of the
- 16 Hanford Facility Dangerous Waste Permit Application must contain a description of the training plan.
- 17 Training plan documentation is maintained outside of the Hanford Facility Dangerous Waste Part B
- 18 Permit Application and the HF RCRA Permit. Therefore, changes made to the training plan
- documentation are not subject to the HF RCRA Permit modification process. However, the training plan
- documentation is prepared to comply with WAC 173-303-330(2).
- 21 Documentation prepared to meet the training plan consists of hard copy and/or electronic media as
- 22 provided by HF RCRA Permit (DW Portion), Condition II.C.1. The training plan documentation consists
- of one or more documents and/or a training database with all the components identified in the core
- 24 document.
- A description of how training plan documentation meets the three items in WAC 173-303-330(2) is as
- 26 follows:
- 27 1. -330(2)(a): "The job title, job description, and name of the employee filling each job. The job
- description must include requisite skills, education, other qualifications, and duties for each position."
- 29 <u>Description</u>: The specific Hanford Facility personnel job title/position is correlated to the waste
- 30 management duties. Waste management duties relating to WAC 173-303 are correlated to training
- 31 courses to ensure training properly is assigned.
- Only names of Hanford Facility personnel who carry out job duties relating to TSD unit waste
- management operations at the 242-A Evaporator are maintained. Names are maintained within the
- training plan documentation. A list of Hanford Facility personnel assigned to the 242-A Evaporator
- is available upon request.
- 36 Information on requisite skills, education, and other qualifications for job titles/positions are addressed by
- providing a reference where this information is maintained (e.g., human resources). Specific information
- 38 concerning job title, requisite skills, education, and other qualifications for personnel can be provided
- 39 upon request.

- 2. -330(2)(b): "A written description of the type and amount of both introductory and continuing training required for each position."
- Description: In addition to the outline provided in Section 8.1, training courses developed to comply with the introductory and continuing training programs are identified and described in the training plan documentation. The type and amount of training is specified in the training plan documentation

6 as shown in Table 8-1.

12

- 3. -330(2)(c): "Records documenting that personnel have received and completed the training required by this section. The Department may require, on a case-by-case basis, that training records include employee initials or signature to verify that training was received."
- Description: Training records are maintained consistent with Attachment 33, Chapter 8.0, Section 8.4 (DOE/RL-91-28).

Table 8.1. 200 Area Liquid Waste Processing Facilities Training Matrix.

			Tr	aining Cate	gory*		
Attachment 33 Chapter 8 Training Category (DOE/RL-91-28)	General Contingency Emergency Hanford Plan Coordinator Facility Training Training		Operations Training				
200 Area Liquid Waste Processing Facilities DWTP implementing category	Orientation Program	Emergency Response (contingency plan)	Emergency Coordinator Training	General Waste Management	Container Management	Tank System Management	Surface Impoundment
Job title/position		7			٠,		
Nuclear Chemical Operators (NCOs)	X	X		X	X	X	X
Shift Technical Advisor (STAs)	X	X					
Shift Operations Manager (SOMs)	X	X	X				
Environmental Compliance Officer	X			X			
Resident Waste Service Provider	X			X	X		
Non-Resident Waste Service Provider	х			X			

<sup>\*</sup> Refer to the 200 Area Liquid Waste Processing Facilities Dangerous Waste Training Plan for a

complete description of coursework in each training category. The 200 Area Liquid Waste Processing

Facilities Dangerous Waste Training Plan address the 242-A Evaporator, the 200 Area Effluent Treatment

<sup>16</sup> Facility, and the Liquid Effluent Retention Facility.

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23 24	11.6	SCHEDULE FOR CLOSURE	Att 35.11.6

## 11.0 CLOSURE AND FINANCIAL ASSURANCE

- 2 This chapter describes the planned activities and performance standards for closing the 242-A Evaporator.
- 3 Final closure will begin when the 242-A Evaporator is no longer needed.

# 4 11.1 CLOSURE PLAN/FINANCIAL ASSURANCE FOR CLOSURE

- 5 The 242-A Evaporator will be clean closed with respect to dangerous waste contamination that resulted
- 6 from operation as a TSD unit. To facilitate closure, the 242-A Evaporator is being viewed as consisting
- 7 of six components: tanks, ancillary equipment, piping, concrete floors/liners, structures, and underlying
- 8 soil. Only areas that have treated, stored, or handled dangerous waste will undergo closure activities.
- 9 Remedial actions with respect to contamination that was not a result of use of these areas for treatment,
- storage, or handling of dangerous waste are outside the scope of this closure plan.
- 11 Contaminated equipment, tanks, and piping removed from the 242-A Evaporator will be considered
- 12 "debris" and transported to an appropriate permitted treatment, storage, or disposal unit for final
- 13 disposition. Uncontaminated structures will be left for future use or disassembled, dismantled, and
- 14 removed for disposal. Uncontaminated equipment and structures could include aqueous makeup, HVAC
- and piping, steam condensate and cooling water piping, and the control room and office areas.
- 16 The pipes located west and north of the 242-A Evaporator, which connect to A Farm and AW Farm, are
- in the same bundles with pipes used for transfers between tanks in the DST System. To minimize
- 18 radiation exposure during closure, these pipes will be closed at the same time the piping for the
- 19 DST System is closed. Closure of these pipes will be performed per Double-Shell Tank System
- 20 Dangerous Waste Permit Application (DOE/RL-90-39). The pipelines between the 242-A Evaporator
- 21 and the 207-A pump pit, and in the 207-A pump pit, used for transfer of process condensate, will be
- 22 closed per this closure plan.
- 23 Clean closure requires decontamination or removal and disposal of all dangerous waste, waste residues.
- 24 contaminated equipment, soil, or other material established in accordance with the clean closure
- 25 performance standards of WAC 173-303-610(2). This and future closure plan revisions will provide for
- 26 compliance with these performance standards. All work will be performed ALARA with respect to
- 27 worker exposure to dangerous and/or any other workplace hazards. Activities that are planned to achieve
- 28 clean closure are presented in the following sections.

## 29 11.2 CLOSURE PERFORMANCE STANDARD

- 30 Clean closure, as provided for in this plan, and in accordance with WAC 173-303-610(2), will eliminate
- 31 future maintenance and will be protective of human health and the environment.
- 32 After closure, the appearance of the land where the 242-A Evaporator is located will be consistent with
- 33 the appearance and future use of the surrounding land areas. This closure plan proposes to leave clean
- 34 structures and equipment in place after closure for potential future operations. This need will be
- 35 evaluated at the time of closure.

36

### 11.2.1 Closure Standards for Metal Surfaces, and Concrete

- 37 This closure plan proposes use of a 'clean debris surface' (defined in the following paragraph) as the clean
- 38 closure performance standard for the metal surfaces, and concrete that will remain after closure. This
- 39 approach is consistent with Ecology guidance (Ecology 1994) for achievement of clean closure.

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- Attainment of a clean debris surface can be verified visually in accordance with the standard that states, 1
- "A clean debris surface means the surface, when viewed without magnification, shall be free of all visible 2
- contaminated soil and hazardous waste except residual staining from soil and waste consisting of light 3
- shadows, slight streaks, or minor discolorations and soil and waste in cracks, crevices, and pits may be 4
- present provided that such staining and waste and soil in cracks, crevices, and pits shall be limited to no 5
- more than 5% of each square inch of surface area" (40 CFR 268.45). 6
- Decontamination of concrete, per the 'debris rule' is based on a physical extraction method 7
- (40 CFR 268.45, Table 1). The performance standard is based on removal of the contaminated layer of 8
- debris. The physical extraction performance standard for concrete is removal of 0.6 centimeter of the 9
- surface layer and treatment to a clean debris surface. 10

#### 11.2.2 Closure Standards for Tanks . 11

- Using the 242-A Evaporator's decontamination system, the tank system could be flushed and 12
- decontaminated. The rinsate will be sampled and analyzed. Results of the analysis with less than 13
- designation limits for the constituents of concern will be accepted as indicating that the tanks are clean 14
- with respects to dangerous waste residues. An alternative to decontaminating the tanks is to remove and 15
- dispose of the tanks accordingly. 16

#### 11.2.3 Closure Standards for Internal and/or External Piping 17

- The internal and/or external piping of 242-A Evaporator will be flushed and drained as part of closure. 18
- The rinsate will be sampled, and analyzed. Results less than designation limits, for the constituents of 19
- concern will be accepted as indicating that the piping is clean with respect to dangerous waste or 20
- dangerous waste residues. 21

### 11.2.4 Closure Standards for Ancillary Equipment 22

- Ancillary equipment is defined as pumps and other miscellaneous equipment not otherwise specified in 23
- this closure plan. Ancillary equipment will be removed and disposed. 24

#### 11.2.5 Closure Standards for Underlying Soils 25

- Clean closure of soil under the 242-A Evaporator will be accomplished by determining that the coated 26
- concrete floor and stainless steel liners, kept contaminants from reaching the soil. The coated concrete 27
- and liners provided secondary containment for all the tanks, process piping, and ancillary equipment 28
- within the building. Unless inspections identify potential through-thickness cracks indicating 29
- containment failure and a subsequent potential for soil contamination from TSD unit operations, the soil 30
- will be considered clean closed. However, if inspections identify such cracks, and there have been 31
- documented spills in the vicinity, potential soil contamination will be investigated. Soils will be sampled 32
- and analyzed for constituents of concerns. If the soil analytical results determine that, the constituents of 33
- concern are at or below agreed to regulatory cleanup levels, the soil will be considered clean closed. The 34
- Hanford Facility RCRA Permit Condition II.K defines regulatory cleanup levels. Sampling and disposal 35
- objectives will be determined at the time of closure activities through the data quality objectives process. 36
- If verification sampling is required, a sampling analysis plan will be prepared before closure in a manner
- 37 consistent with Ecology guidance (Ecology 1994) for achievement of clean closure. 38

#### 11.3 CLOSURE ACTIVITIES 39

- At the time of closure, the closure plan will be modified as necessary to reflect current regulations and 40
- information. If it is determined that clean closure is not possible, the closure plan will be modified to 41
- address required postclosure activities. 42

### 11.3.1 General Closure Activities

- 2 The approach to 242-A Evaporator closure is to dispose of accumulated liquid waste by transferring the
- 3 waste to the LERF. After the waste has been removed, clean closure of the tanks, process equipment, the
- 4 piping, concrete/liners, and the structures will be accomplished by decontaminating the components, as
- 5 necessary, and demonstrating that clean closure performance standards are met. Clean closure of the soil
- 6 will be accomplished by demonstrating that the concrete and liners kept the contaminants from reaching
- 7 the soil. If it is determined, that soil contamination is possible, investigation and cleanup of the soils will
- 8 be managed appropriately. All work will be performed ALARA with respect to worker exposure to
- 9 dangerous and/or mixed waste, radioactivity, hazardous chemicals, or any other workplace hazards.
- 10 Contamination, if present, will be managed in compliance with regulatory requirements.
- 11 Equipment or materials used in performing closure activities will be decontaminated or disposed at a
- 12 permitted facility.

# 13 11.3.2 Constituents of Concern for Closure for 242-A Evaporator

- Based on process knowledge and the risk to human health and the environment, the constituents of
- concern for closure will be selected from the list of dangerous waste numbers in Attachment 35,
- 16 Chapter 1.0 through the data quality objective process.

## 17 11.3.3 Removing Dangerous Waste

- All of the waste inventory at the 242-A Evaporator will be processed before closure. Any residue
- remaining in piping and equipment will be removed to an appropriate TSD unit.

# 20 11.3.4 Decontaminating Structures, Equipment, and Soils

- 21 Before closure activities begin, all waste inventories will be removed. To facilitate closure, tanks,
- 22 internal and/or external piping, ancillary equipment, concrete floors/liners, structures, and soil directly
- 23 beneath the structure will be decontaminated, as necessary, to demonstrate that the clean closure
- 24 performance standards are met.
- 25 Removal and disposal of most of the components will be determined at the time of closure. Clean closure
- 26 of the soil will be accomplished by demonstrating that the concrete/liners kept contaminants from
- 27 reaching the soil.

### 28 11.3.4.1 Tanks

- 29 After all pumpable waste has been removed from the tanks, the interior of the tanks, including the internal
- 30 components such as the agitator, either will be flushed and decontaminated by adding or spraying with
- 31 steam, a water-soluble cleaner, or other approved method, or removed as debris and disposed
- 32 appropriately.
- If the tanks are decontaminated, the tanks will be inspected visually for compliance with the performance
- 34 standard. Because of possible radiation exposure, visual inspection of the vapor-liquid separator will be
- made remotely using a camera or other device that allows verification of meeting the standard. If any
- 36 areas are found not to meet the clean debris surface performance standard, these areas will be
- 37 decontaminated in-place. Per the debris rule, only removal of contaminants from the surface layer is
- 38 necessary for metal surfaces. Contamination will be removed from the surface layer using either
- 39 high-pressure water blasting (a physical extraction method) or by hand or remote wiping, washing,
- 40 brushing, or scrubbing using an approved cleaner, and rinsing with water or by other appropriate
- 41 methods.

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- If the decontamination option is used, the outside of the tanks also will be inspected for compliance to the
- performance standard. Any areas found not to meet this performance standard will be decontaminated
- 2 in-place. Contamination will be removed from the surface layer using any of the methods described for
- internal tank decontamination or another appropriate method. Before using decontamination solutions on 4
- the outside of the tanks, the floor will be inspected for cracks or other openings that could provide a 5
- pathway to soil. This inspection will be performed as described in Section 11.2.1 in conjunction with 6
- mapping of potential through-thickness cracks. Any such cracks will be mapped. The cracks will be 7
- sealed before beginning treatment or other engineered containment devices (e.g., collection basins) will 8
- 9 be used to collect and contain solutions.
- Decontamination residues will be collected, designated, and managed. If it is not possible to meet the 10
- clean closure performance standard, contaminated portions of the tanks could be removed, designated, 11
- and disposed of accordingly. The inspections for a clean debris surface will be documented on an 12
- inspection record. 13

#### 11.3.4.2 Internal and/or External Piping and Ancillary Equipment 14

- The initial closure activity for the piping that is associated with the areas undergoing closure will be to 15
- identify the lines that might have carried dangerous waste. Only piping that might have carried dangerous 16
- waste will undergo closure activities. 17
- The piping that will undergo closure will be rinsed and the rinsate will be sampled and analyzed for the 18
- constituents of concern. The constituents of concern will be based on knowledge of what constituents 19
- were in the dangerous waste carried through the particular piping. The flushing, sampling, and analysis 20
- will be repeated until the rinsate no longer designates as dangerous waste. If the rinsate does not 21
- designate based on the concentrations of the constituents of concern, the piping will be considered clean 22
- with respect to this closure. If necessary, the piping will be rinsed with a decontamination solution before 23
- sampling and analyses. If it is not possible to meet the clean closure standard, portions of the piping will 24
- be removed, designated, and disposed of accordingly. The ancillary equipment will be removed, 25
- designated, and disposed of accordingly. 26
- The 207-A pump pit, located east of the 242-A Evaporator, will be closed using the performance 27
- standards for pipes and concrete. A visual inspection will be performed. If the interior surfaces meet, the 28
- performance standards, the 207-A pump pit will be considered clean closed. If the performance standards 29
- are not met, the interior surfaces will be cleaned using an appropriate decontamination method and the 30
- method repeated until the surfaces meet the clean closure performance standard. 31

#### 11.3.4.3 Concrete/Liner 32

- The coated concrete floor and the pump room sump liner provide secondary containment for all the tanks, 33
- process piping, and ancillary equipment. All concrete and liners will be inspected visually and surveyed 34
- radiologically before any decontamination. The purpose of the inspection will be twofold: to identify 35
- and map any cracks in the concrete that might have allowed contaminants a pathway to the soil below and 36
- to identify areas that potentially are contaminated with dangerous waste or dangerous waste residues. The 37
- inspection standard will be a clean debris surface as defined in Section 11.2.1. The inspection of the 38
- concrete for a clean debris surface will be documented on an inspection record. Those areas already 39
- meeting the standard will be clean closed as is. 40
- Those potentially contaminated areas will undergo decontamination to meet the clean closure standard of 41
- a clean debris surface. The concrete will be washed down; the rinsate collected, designated, and disposed 42
- of accordingly. The concrete will be re-inspected for a clean debris surface. Concrete surfaces indicated 43
- by visual examination, as potentially still being contaminated will have the surface layer removed to a 44
- depth of 0.6 centimeter by scabbling or other approved methods. This will not threaten the environment, 45

- even if potential through-thickness cracks had been found during the inspection, because concrete
- 2 decontamination (scabbling) will not employ liquid solutions that could enter cracks and because
- 3 scabbling residues will be vacuumed away from cracks as any residue is generated.
- 4 Achievement of a clean debris surface will be documented on an inspection record. Decontamination
- 5 residues will be collected, designated, and managed as appropriate.

### 6 11.3.4.4 Structures

- 7 If contaminated with either dangerous or mixed waste constituents, structures will be decontaminated
- 8 and/or disassembled, if necessary, packaged, and disposed in accordance with existing land disposal
- 9 restrictions (WAC 173-303-140).
- 10 Closure steps could include the following activities.
- Containerize (as necessary and practicable) and remove any remaining waste.
- Review operating records for spillage incidents and visually inspect area surfaces for evidence of
- contamination or for cracks that could harbor contamination or allow the escape of decontamination
- solutions. Inspect storage area surfaces for visible evidence of contamination (e.g., discoloration,
- material degradation, wetness, and odor). If contamination is evident, the affected area(s) will be
- decontaminated.
- Decontaminate walls and floors to minimize the potential for loose contamination and to facilitate any
- required radiation surveys and/or chemical field screening. Wash down could be by water rinse or
- high-pressure, low-volume steam cleaning coupled with a detergent wash. After decontamination, the
- building walls and floor will be compared to closure performance standards.
- Collect rinsate and manage as dangerous waste for appropriate disposal.
- Secure (lock) personnel entries into building and post doors with appropriate warning signs.
- 23 Clean closure of structures will occur in accordance with WAC 173-303-610. Remediation of soil
- 24 contamination beneath or around containment buildings will be performed in conjunction soil closure
- 25 requirements.

### 26 11.3.4.5 Underlying Soils

- 27 Clean closure of soil under the 242-A Evaporator will be accomplished by demonstrating that the coated
- 28 concrete floor and stainless steel liners kept contaminants from reaching the soil. The coated concrete
- 29 floor provided secondary containment for all the tanks, process piping, and ancillary equipment. Unless
- 30 inspections identify potential through-thickness cracks indicating containment failure and a subsequent
- 31 potential for soil contamination from TSD unit operations, the soil will be considered clean closed.
- However, if inspections identify such cracks, and there have been documented spills in the vicinity,
- potential soil contamination will be investigated.
- Where it is possible visually to inspect directly beneath the tanks, a visual inspection will be performed.
- Where it is not possible visually to inspect beneath the tanks, an evaluation of the tank integrity will be
- made. The condition of the tank will be evaluated to determine if there was any potential for leakage. If
- 37 no cracks, severe corrosion, or evidence of leaks is observed, it will be reasoned that mixed or dangerous
- waste solutions could not have penetrated to the soil directly below the tank.

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- External piping between the 242-A Evaporator and the 207-A pump pit is double-lined with a leak
- detection system. If records indicate that no leaks from the primary piping occurred, the soil will be
- 3 considered clean with respect to RCRA closure.

## 4 11.4 MAXIMUM WASTE INVENTORY

- 5 The 242-A Evaporator is used to treat mixed waste from the DST System by removing water and most
- 6 volatile organics. Two waste streams leave the 242-A Evaporator following the treatment process. The
- 7 first waste stream, the concentrated slurry (in which approximately half the water content is removed and
- 8 a portion of the volatile organics), is pumped back into the DST System. The second waste stream,
- 9 process condensate (containing a portion of the volatile organics removed form the mixed waste during
- the evaporation process), is routed through condensate filters before being transferred to LERF. The
- 242-A Evaporator is used to treat up to 870,642 liters of mixed waste per day.
- 12 Tank C-100 receives process condensate and potentially contaminated drainage from the vessel vent
- system. The maximum design capacity for the C-100 tank is 67,380 liters.
- 14 Vapor-liquid separator, C-A-1, is located in the evaporator room and is used to separate vapor from the
- boiling slurry solution and deentrain liquid from the vapor before it enters the condensers in the
- 16 condenser room. The maximum design capacity of C-A-1 is 103,217 liters.

# 17 11.5 CLOSURE OF TANKS

- 18 Clean closure of 242-A Evaporator will consist of the removal and disposal of all dangerous waste and
- 19 the decontamination and/or removal and disposal of contaminated equipment, including tanks.

# 20 11.6 SCHEDULE FOR CLOSURE

- 21 Closure of 242-A Evaporator is not anticipated to occur within the next 15 to 20 years. The actual year of
- 22 closure will depend on the time required for current waste to be processed and what role the
- 23 242-A Evaporator will play in processing additional waste generated during future activities in the
- 24 200 Areas. Other factors affecting the year of closure include changes in operational requirements,
- 25 lifetime extension upgrades, and unforeseen factors. When a definite closure date is established, a revised
- 26 closure plan will be submitted to Ecology. The activities required to complete closure are planned to be
- 27 accomplished within 180 days. Should a modified schedule be necessary, a revised schedule will be
- 28 presented and agreed to before closure.

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### 12.0 REPORTING AND RECORDKEEPING

- 2 Reporting and recordkeeping requirements that could be applicable to the Hanford Facility are described
- 3 in Attachment 33, General Information Portion, Chapter 12.0 (DOE/RL-91-28). Not all of these
- 4 requirements and associated reports and records identified in Chapter 12.0 of the General Information
- 5 Portion are applicable to the 242-A Evaporator. Those reporting and recordkeeping requirements
- 6 determined to be applicable to the 242-A Evaporator are summarized as follows:
- Hanford Facility Contingency Plan and incident records (as identified in the General Information
   Portion):
- 9 Immediate reporting
- 10 Written reporting.
- Unit-specific permit documentation and associated plans
- Personnel training records
- 13 Inspection records (unit)
- Land disposal restriction records
- Waste minimization and pollution prevention.
- 16 In addition, the following reports prepared for the Hanford Facility will contain input, when appropriate,
- 17 from the 242-A Evaporator:
- Quarterly Hanford Facility RCRA Permit modification report
- Anticipated noncompliance
- Required annual reports.
- 21 Annual reports updating projections of anticipated costs for closure and postclosure will be submitted
- when the 242-A Evaporator closure plan is submitted to Ecology (Attachment 35, Chapter 11.0).
- 23 The 242-A Evaporator Operating Record 'records contact' is kept on file in the General Information file of
- the Hanford Facility Operating Record (refer to Attachment 33, Chapter 12.0 [DOE/RL-91-28]).

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# 13.0 OTHER FEDERAL AND STATE LAWS

- 2 Applicable federal, state, and local laws applicable to the 242-A Evaporator are discussed in
- 3 Attachment 33, General Information Portion, Chapter 13.0 (DOE/RL-91-28). Generally, the laws
- 4 applicable to the 242-A Evaporator include, but might not be limited to, the following:
- 5 Atomic Energy Act of 1954
- 6 Federal Facility Compliance Act of 1992
- 7 Clean Air Act of 1977
- 8 Safe Drinking Water Act of 1974
- 9 Emergency Planning and Community Right-to-Know Act of 1986
- 10 Toxic Substances Control Act of 1976
- 11 National Historic Preservation Act of 1966
- 12 Endangered Species Act of 1973
- 13 Fish and Wildlife Coordination Act of 1934
- 14 Federal Insecticide, Fungicide, and Rodenticide Act of 1975
- 15 Hazardous Materials Transportation Act of 1975
- 16 National Environmental Policy Act of 1969
- 17 Washington Clean Air Act of 1967
- 18 Washington Water Pollution Control Act of 1945
- 19 Washington Pesticide Control Act of 1971
- 20 New Source Construction Permits
- 21 Model Toxics Control Act
- 22 Benton Clean Air Authority Regulation 1
- 23 State Environmental Policy Act of 1971.

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# **APPENDIX 4B**

THE 242-A	<b>EVAPOR</b>	ATOR/CI	RYSTAL	LIZER	<b>TANK</b>	<b>SYSTEM</b>
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1998 INTERIM 242-A EVAPORATOR TANK SYSTEM INTEGRITY ASSESSMENT REPORT

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## 1.0 INTRODUCTION

### 1.1 General Comments

This Integrity Assessment Report (IAR) is prepared by Fluor Daniel Northwest (FDNW) under contract to Lockheed-Martin Hanford Company (LMHC) for Waste Management Hanford (WMH), the 242-A Evaporator (facility) operations contractor for Fluor Daniel Hanford, and the U.S. Department of Energy, the system owner. The contract specifies that FDNW perform an interim (5 year) integrity assessment of the facility and prepare a written IAR in accordance with Washington Administrative Code (WAC) 173-303-640(2).

The WAC 173-303 defines a treatment, storage, or disposal (TSD) facility tank system as the "dangerous waste storage or treatment tank and its ancillary equipment and containment." This integrity assessment evaluates the two tank systems at the facility: the evaporator vessel, C-A-1 (also called the vapor-liquid separator), and the condensate collection tank, TK-C-100. This IAR evaluates the 242-A facility tank systems up to, but not including, the last valve or flanged connection inside the facility perimeter. The initial integrity assessment performed on the facility (Appendix A: Reference 13) evaluated certain subsystems not directly in contact with dangerous waste, such as the steam condensate and used raw water subsystems, to provide technical information. These subsystems were not evaluated in this IAR.

The last major upgrade to the facility was project B-534. The facility modifications, as a result of project B-534, were evaluated in the 1993 facility interim integrity assessment. Since that time, the following upgrades have occurred in the facility:

- Installation of a process condensate recycle system.
- Installation of a package steam boiler to provide steam for the facility. The package boiler is not within the scope of the facility TSD.

 Rerouting of the steam condensate and used raw water systems to the treated effluent disposal facility (TEDF).
 Steam condensate and used raw water are not dangerous wastes.

## 1.2 System Description

The purpose of the 242-A Evaporator is to reduce the volume of dangerous waste requiring interim storage in underground double shell tanks (DST) for eventual treatment and disposal. The waste volume reduction is achieved via evaporative concentration. The facility is designed and equipment selected to maintain a set boil-off rate of 2.65 liters/second (40 gallon/minute) at a feed rate of 4.4 to 7.6 liters/second (70-120 gallons/minute), yielding a waste volume reduction factor ranging from 35 percent to 60 percent. The facility has seven operational subsystems that are described as follows:

- 1. Evaporator Process and Slurry Subsystem: The evaporator and process slurry subsystem circulates the waste feed through the evaporator and the reboiler vessels, boiling off water vapor and concentrating the waste into a slurry. The water vapor is routed through the vapor condenser subsystem and the concentrated slurry is sent to a double shell tank. The evaporator vessel and the associated recirculation loop/reboiler are a dangerous waste storage tank system subject to the tank requirements of WAC 173-303.
- 2. Vapor Condenser Subsystem: The vapor condenser (VC) subsystem includes the three condensers operated within the facility. They condense the water vapor from the evaporator to form the process condensate (PC). The PC goes through the PC subsystem. The uncondensed vapors and non-condensable gases are filtered and monitored for radioactive contamination prior to discharge to the atmosphere through the vessel vent subsystem. The vapor condenser subsystem is ancillary equipment associated with the condensate collection tank which is a dangerous waste storage tank system subject to the tank requirements of WAC 173-303.

- 3. Vessel Vent Subsystem (NON-DANGEROUS WASTE SUBSYSTEM): The vessel vent (VV) subsystem contains a series of high-efficiency particulate air (HEPA) filters, deentrainment pads, radiation monitoring system, and various heating and ventilating equipment. Uncondensed vapors and non-condensable gases that have been passed through the VC subsystem are filtered and vented to the atmosphere through this subsystem.
- 4. Process Condensate Subsystem: The PC subsystem receives the condensed water vapors (process condensate) from the vapor condenser subsystem. The process condensate drains into the condensate collection tank, TK-C-100, and is transferred to the liquid effluent retention facility If additional decontamination is necessary prior to transferring process condensate to the LERF, the process condensate may be sent through the IX-D-1 ion exchange column to reduce the cesium (Cs) and strontium (Sr) content of the PC. However, use of the IX-D-1 is not anticipated for the duration of the life expectancy of the facility. The process condensate subsystem is continuously monitored for radioactive contamination by the RC-3 radiation monitor. In the event of radioactive contamination above the RC-3 monitoring/diversion system activation setpoint, the process condensate is automatically diverted back to the TK-C-100 condensate catch tank or the 241-AW-102 feed tank. condensate collection tank is a dangerous waste storage tank system subject to the tank requirements of WAC 173-303.
- 5. Steam Condensate Subsystem (NON-DANGEROUS WASTE SUBSYSTEM): The steam condensate subsystem routes steam condensed in the reboiler to the TEDF. The steam condensate subsystem has an in-line radiation monitor, RC-1, which continuously monitors for excessive radioactive contamination. In the event of radiation detection in the system, the steam condensate discharge will be stopped through the SC-501 pipeline from the facility and diverted to the 241-AW-102 feed tank.

- 6. Raw Water Disposal Subsystem (NON-DANGEROUS WASTE SUBSYSTEM): The raw water disposal subsystem discharges raw water used as the coolant for the condensers to TEDF. The raw water disposal subsystem is continuously monitored for radioactive contamination with the RC-2 radiation monitor. In the event of radioactive contamination above the RC-2 monitoring system activation setpoint, an alarm sounds and the system is manually shut down.
- 7. Building and Secondary Containment Subsystem: This subsystem includes the evaporator building structure and the associated sump and drain systems. The operating area is a poured-in-place concrete structure divided into six specific rooms. Those portions of the structure that may come in contact with the waste solutions are coated with a chemically resistant acrylic coating or lined with stainless steel catch pans.

The facility rooms have drains which route spills away from occupied areas. The sump drains from a 10 inch overflow line to the 241-AW-102 feed tank. Drains from areas containing low activity process condensate, drain through a 6 inch line directly to the 241-AW-102 feed tank. A third drain line to the 241-AW-102 feed tank is used to quickly drain the evaporator vessel in an emergency.

1.2.1 Operating Parameters: Operating parameters for the 242-A Evaporator include the pressures and temperatures listed in Appendix G: Table G-1. The system temperatures and pressures were calculated from the appropriate process flow and operational data sheet design parameters for the components listed in this Appendix.

### 1.3 Scope

The scope of this integrity assessment is based on the recommendations in the original integrity assessment report. The major tasks associated with this integrity assessment include:

 a. Nondestructive examination (NDE) of selected locations and components

b. Leak test of the evaporator/reboiler system and the condensate collection tank

- Visual walkdown of the facility for signs of degradation
- d. Review of operating logs and occurrence reports for events which may have caused degradation to the vessels
- e. Review of original integrity assessment documentation to determine baseline status
- f. Review of national codes and standards and DOE Orders to determine if there are significant new or revised requirements related to integrity of existing facilities.

This integrity assessment is limited to those vessels and piping within the facility which contain dangerous waste solutions. It does not include transfer piping or systems which do not contain dangerous waste. This IAR is certified by an Independent Qualified Registered Professional Engineer (IQRPE).

### 1.4 Comments on Certification

Paragraph 3.0 contains a certification on the accuracy of the information presented in this report. The certificate is signed and sealed by an Independent Qualified Registered Professional Engineer (IQRPE) in accordance with WAC 173-303-640(2).

### 2.0 ASSESSMENT

The integrity of the tank system described above, paragraph 1.2, is adequate to prevent failure caused by corrosion or by structural loads imposed by the system's intended service. See Appendix A, (1), (7), and (13) for a complete description of the system and intended service. The conclusions presented are based on performed system leak tests, walkdowns, ultrasonic tests, and a review of the applicable codes, standards, design, and construction documents, in addition to the previous interim integrity assessment. The following paragraphs (2.1 - 2.5) discuss specific considerations to ensure the facility's tank system complies with the requirements of WAC 173-303-640(2).

### 2.1 Codes and Standards

Because the systems at the facility which handle dangerous waste have not undergone any significant modifications or revisions to the tank system, an in depth review of the applicable codes and standards was not performed for this IAR. The review and evaluation of the codes and standards performed for the 1993 IAR is sufficient for this report.

## 2.2 Waste Characterization

The 242-A Evaporator facility receives and treats Washington State dangerous waste (categorized as "Extremely Hazardous Waste" by the RCRA Part A permit application) (Appendix A: Reference 7). The generation of this waste is the result of past Hanford defense production operations. These wastes are feed stock to the 242-A Evaporator. The process condensate produced by evaporation is categorized as a "Dangerous Waste" and is essentially water with only trace contaminants.

The chemistry associated with the various process waste streams in the facility (e.g., evaporator feed, double shell slurry feed, process condensate, cooling water, and steam condensate) are classified as dangerous waste streams. The current chemical composition of these waste streams is the same as those reported in the facility's baseline integrity assessment. Therefore, the waste characterization evaluation of the streams that was performed for the 1993 IAR is still valid for this IAR. (See Appendix G: Table G-4 for bulk chemistry.)

### 2.3 Tank System Age

Construction of the 242-A Evaporator was completed in 1977 at which time it became operational. The facility's original design life was ten years (Appendix A: Reference 1). The TK-C-100 Condensate Catch Tank was fabricated in 1951 as part of another project; however, this catch tank was never used on that project. The tank was upgraded in 1977 to be consistent with the 242-A Evaporator facility design standards and installed in the 242-A facility. As a result of Project B-534, some facility components were upgraded or replaced. These components were evaluated in

the last 242-A facility integrity assessment (Appendix A: Reference 13) and not identified for special evaluation for this integrity assessment.

Those components that were affected by Project B-534 are noted here for historical record. They include:

Components	<u></u>	Year
E-C-1 Primary	Condenser	1990
P-B-1 Pump		1990
P-B-2 Bottoms	Pump	1990
Miscellaneous	Process Piping	1990

The 242-A Evaporator is conveniently described by seven subsystems according to the function or process of each subsystem as described below. Four of the subsystems store, transport or treat Washington State dangerous wastes, the other three subsystems do not.

### 2.4 Potential for Corrosion Failure

The conclusion of this IAR concerning corrosion failure is that the facility is in good condition and can continue operation. This conclusion is based on ultrasonic testing data of various systems, and a comparison of this data with similar data for the 1993 integrity assessment. technical support for this conclusion is that the types of dangerous wastes currently available for processing in the facility have not changed since the facility became operational in 1977. Ultrasonic tests made of the wall thicknesses for the evaporator/reboiler loop, condensate catch tank (TK-C-100), and process condensate condensers made in 1993 and 1998, are essentially the same, and are within the margin of error of the testing equipment. This indicates that there has been no measurable or noticeable deterioration of the tank system's integrity. See Appendix E for comparison of the two sets of UT data.

Also, a corrosion evaluation, based on the UT data for this integrity assessment, verified that the chemistry of the waste streams introduced to the facility have had a minimal effect on the equipment. Therefore, the conclusions concerning corrosion failure that were arrived at in the 1993 IAR remain valid for this report.

The following are general comments concerning corrosion failure:

- The materials of construction, system design, and protective coatings for the 242-A facility tank system provide adequate corrosion protection and compatibility with Hanford defense wastes and the process streams generated within the facility. The wall thicknesses of the equipment and piping are above the "T-nom" thickness minus the mill tolerance which is the minimum thickness expected during original construction (see Appendix E: E-1). This is consistent with the results of the 1993 IAR.
- The 242-A Evaporator corrosion protection program consists of materials, methods of construction, and control the process chemistry for the liquid waste environments. The facility components and piping are constructed primarily of austenitic stainless steels and low alloy carbon steels. Gaskets at component and piping connections are chemically resistant non-metallics. Each subsystem was designed for specific operating parameters and material/environment compatibilities.
- Based on the corrosion evaluation, it is recommended that all accessible equipment and grid points that were tested in for the 1993 integrity assessment be tested during the next integrity assessment. That will provide for a more extensive corrosion rate evaluation, and a more exhaustive evaluation can be made to establish the remaining equipment life (see Appendix E).

## 2.5 Leak Test and System Walkdown

Hydrostatic leak tests were performed on the C-100 Condensate Catch Tank and the Evaporator/Reboiler loop. The criteria for acceptable leak tests of these systems was "no detectable leaks" over a 24 hour period.

The leak test data and walkdown inspection results were reviewed and sign off by the 242-A Facility Cognizant Engineer and Quality Assurance representative. Final disposition of the condensate catch tank and evaporator/reboiler loop is: "System and components are

acceptable based on the inspection results. No further evaluation is required."

- 2.5.1 C-100 Condensate Catch Tank Leak Test: This leak test was conducted with the same criteria as the 1993 integrity assessment (Appendix A: Reference 13). This test was conducted in accordance with process memo LW98-026 (Appendix D: D-1). The leak test duration was 24 hours and the result was that the system passed the test on the first attempt.
- 2.5.2 Evaporator/Reboiler Loop Leak Test: The leak test for the evaporator/reboiler loop was conducted in accordance with process memo LW98-44 (Appendix D: D-3). The leak test duration for this system was 28 hours. evaporator/reboiler loop was filled with 27,507 gallons of water as measured on the LIC-CA1 liquid level indicator. Liquid level measurement readings of the loop were taken every hour during the test. The liquid level varied from plus 5 gallons to minus 11 gallons from the initial liquid level in the loop. These variations are within the operating range of the level measuring equipment and the minor temperature fluctuations in the system. Readings were taken on tank 241-AW-102, the evaporator drain tank, before and after the test. During the leak test, seal water for the recirculation pump, P-B-1, was routed to Tank 241-AW-102. This accounts for the liquid level increase in Tank 241-AW-102.
- 2.5.3 Visual Inspection of Evaporator/Reboiler Room Concrete Coating: During the visual inspection of the evaporator/reboiler equipment in the evaporator/reboiler room, an inspection of the secondary containment concrete and special protective coating (floor and partial wall) was performed. There were no signs of deterioration or wear of the protective coating (see Appendix D: D-2 and D-3).

However, the corrosion evaluation performed had one concern about the concrete coating that may come in contact with the waste. That concern is that the coating material is not recommended for immersion services and may not be suitable for this application. The current material being used is a chemically resistant acrylic coating (Carboline D3358 primer and Carboline D3359 topcoat). It is recommended that

several concrete coating/lining manufactures (e.g., Ameron, Standard, Plasite, Koch) be consulted for recommendations on the optimum concrete lining for this service (see Appendix E).

# 2.6 Future Integrity Assessments

2.6.1 Future Integrity Assessment Frequency: The 1993 IAR established a repeat integrity assessment frequency of five years/8,000 hours of operation between interim integrity assessments. The basis for the five year/8,000 hour frequency is that the 242-A Evaporator has an inherent corrosion protection, stringent operational controls, and aggressive preventative programs in place.

Based upon the findings of this IAR, it is recommended that the next facility integrity assessment is performed be no later than July 15, 2008 (ten years after submittal of this IAR.) The basis for this recommendation is that the results of the ultrasonic testing is the "minimum remaining life" for all the equipment tested is greater than 20 years (see Appendix E: E-1). This is with the exception of the E-C-1 condenser, which has a minimum projected remaining life of greater than 13 years. The remaining life estimates are based on the minimum measured thickness (in 1993 or 1998), the average corrosion rate and the nominal Thickness minus the Mill Tolerance thickness. When this thickness is approached, an actual minimum thickness, based on the design pressure and applicable codes can be determined.

In the event of significant off-normal events, such as earthquakes or major process upsets, procedures and mechanisms are in place through the DOE Order system to ensure orderly shut down and complete review of facility integrity prior to restart.

2.6.2 Future Integrity Assessment Scope: The scope of future integrity assessments should include the process subsystems assessed by this report. In addition to WAC

dangerous waste requirements, future integrity assessments should include:

- Complete visual walkdown of the facility and components for the types of degradation identified in paragraph 2.4 of this IAR<sup>1</sup>.
- Repeat leak tests of evaporator/reboiler loop and condensate catch tank in accordance with an IQRPE approved leak test plan.
- Repeat ultrasonic testing for wall thickness of components using the same locations and grids to the maximum extent possible<sup>1</sup>. This data should be compared with the data included in previous IARs and this IAR for trends.
- Review of significant changes (if any) in national consensus codes and standards and DOE Orders for design and construction of this facility.
- Review of off-normal operational events.

<sup>1</sup> Consideration should be given to the cost/benefit of repeat UT and visual inspections for locations where accessibility and as low as reasonably achievable dose rates may be prohibitive.

# INTEGRITY ASSESSMENT CERTIFICATION

"I have reviewed this document and believe the inspections, tests, and analyses described herein are sufficient for assessment of the tank system integrity in accordance with Washington Administrative Code Section 173-303-640(2)."

"I certify under penalty of law, that I have personally examined, and am familiar with, the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Tifft Sherman R.

Fluor Daniel Northwest, Inc. Registered Professional Engineer

Washington State PE Registration #18708

Expiration Date: May 22, 1999

(Original signed and sealed 6-22-98)

ATTACHMENTS

Appendix A (REFERENCES)

### REFERENCES

- 1. HNF-SD-WM-SAR-023, Rev. 2-D, "242-A Evaporator Safety Analysis Report."
- State of Washington, Washington Administrative Code, Chapter 173-303, "Dangerous Waste Regulations", January, 1989.
- 3. WHC-SD-WM-WP-056, Rev. 1, "242-A Evaporator/Reboiler System Evaluation."
- 4. DOE-RL, Hanford Plant Standard, SDC-4.1, Rev. (1972), "Standard Arch-Civil Design Criteria."
- 5. DOE-RL, Hanford Plant Standard, SDC-4.1, Rev. 11, "Standard Arch-Civil Design Criteria."
- 6. RHO-SD-WM-TI-003, Rev. 0, "Compilation of Basis Letters and Communications Referenced in 242-A Evaporator/Crystallizer Specifications."
- DOE/RL, 1997a, "242-A Dangerous Waste Permit Application", DOE/RL-90-42, Rev. 1, 1997, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 8. Internal Memo #23460-90-105, P. C. Ohl to J. E. Geary, 8/22/90, "Operating Parameter Calculations & References."
- 9. Operating Procedure TO-600-040, current revision, "242-A Evaporator-Crystallizer Operation."
- 10. Double Shell Tank Operating Specification Document, OSD-T-151-00007, current revision.
- 11. HNF-SD-WM-SEL-028, Rev. 1, "Safety Equipment List 242-A Evaporator."
- 12. HNF-2331, Rev. 0, "1998 Interim 242-A Evaporator Tank System Integrity Assessment Plan."
- 13. WHC-SD-WM-ER-124, Rev. 1, "242-A Evaporator-Crystallizer Tank System Integrity Assessment Report"

- 14. WHC-SD-WM-WP-019, Rev. 0, "Data Package for 242-A Evaporator/Crystallizer Tank System Integrity Assessment Report"
- 15. LW98-026, Process Memo, "TK-100 Leak Test Instructions," dated March 27, 1998.
- 16. LW98-044, Process Memo, "242A Evaporator Vessel Integrity Test/Boiler Test," dated May 12, 1998.
- 17. EL-98-00009/W (Generic Work Item), "242-A C-100/C-A-1 Tank Integrity Assessment," January 7, 1998.

Appendix B (WASTE CHARACTERIZATION)

# WASTE CHARACTERISTICS

The 242-A Evaporator receives and treats mixed waste, which is dangerous waste combined with radioactive components, from the double-shell tanks. The dangerous waste portion is categorized as an "Extremely Hazardous Waste" by the Washington State Resource Conservation and Recovery Act (RCRA) program. The facility treats the waste by evaporation, separating it into concentrated slurry and dilute process condensate. Both of these streams are also Washington State RCRA dangerous wastes. The Steam Condensate, Raw Water, and Non-Condensable Gases generated by the evaporator process, through subsystems 3, 5, and 6 (paragraph 1.2 of this report), are not Washington State dangerous wastes.

# Evaporator Feed Composition

The 242-A Evaporator receives a mixed blend of feed from tanks throughout the double-shell tank system via the Evaporator Feed Tank, 241-AW-102. The feed contains liquid waste from chemical processing operations, facility deactivations, and miscellaneous facility and laboratory discharges. The largest portion of wastes are non-radioactive aqueous salts. The feeds are highly alkaline (pH>12) and the primary chemical compounds are sodium compounds of hydroxide, nitrite, nitrate, aluminate, carbonate and sulfate. The feed may also contain minor amounts of organic material (<7g/L). The approximate maximum concentrations of the most abundant salts and ammonia are noted in Table B-1, below

The chemical composition of the evaporator feed will vary from run to run and can range from essentially water to saturated solution.

The principal radionuclides in evaporator feed are Cs-137, and Sr-90. Minor and trace quantities of other radionuclides are also present. Similar to the chemical constituents, the concentrations or radionuclides in the feed varies as a function of source and blending.

Table B-1: Chemical Composition of Evaporator Feed

COMPOUND	MAXIMUM CONCENTRATION (M)
NaOH	3.9
NaNO <sub>3</sub>	2.8
NaNO <sub>2</sub>	1.8
NaAlO,	1.8
NaCO <sub>3</sub>	0.7
Na <sub>2</sub> SO <sub>4</sub>	0.2
Na <sub>3</sub> PO <sub>4</sub>	0.5
NH <sub>3</sub>	0.11
NaF	0.07

## Slurry Compositions

Prior to the previous 242-A Evaporator integrity assessment, slurry waste was concentrated to three basic forms. These forms were Dilute Double-Shell Slurry Feed (DDSSF), Double-Shell Slurry Feed (DSSF), and Double-Shell Slurry (DSS). Concentration is performed at the 242-A Evaporator in passes, each pass assumes 50% water removal from the feed solution. DSS is slurry that has been concentrated past the sodium aluminate saturation boundary where massive crystallization/precipitation occurs. concentrated slurry which is one pass away from becoming DSS. Due to tank farm requirements imposed prior to the previous integrity assessment, the sodium aluminate boundary is no longer the controlling factor for target slurry concentrations, but is typically driven by specific gravity (SpG) limits. Therefore, the terms DDSSF, DSSF, and DSS will not be used. Instead, the product will be referred to as concentrated slurry. The maximum concentration of the concentrated slurry is shown in Table B-2.

Table B-2: Chemical Composition of Concentrated Slurry

COMPOUND	MAXIMUM CONCENTRATION (M)
NaOH	5.5
NaNO <sub>3</sub>	5.0
NaNO,	2.5
NaAlO <sub>2</sub>	2.5
NaCO <sub>3</sub>	1.2
Na <sub>2</sub> SO <sub>4</sub>	0.3
Na <sub>3</sub> PO <sub>4</sub>	0.1
NH <sub>3</sub>	0.15
NaF	0.6

Appendix C (DRAWING LIST)

Table C-1: Applicable Drawing List

No.	PEID DRAWING TITLE	DRAWING NUMBER
1	Drawing Index	H-2-98970
2	Process Condensate System	H-2-98990, Sht. 1 (Rev. 8, dated 10/96)
3	Steam Condensate System	H-2-98993, (Rev. 11, dated 9/97)
4	Used Raw Water System	H-2-98994, (Rev. B, dated 10/97)
5	Drain System	H-2-98995, Sht. 1, (Rev. 10, dated 10/97)
	Drain System	H-2-98995, Sht. 2, (Rev. 4, dated 3/95)
7	Evaporator Recir. System	H-2-98988, Sht. 1, (Rev. 4, dated 11/96)
	Evaporator Recir. System	H-2-98988, Sht. 2, (Rev. 4, dated 10/96)
9	Vacuum Condenser System	H-2-98999, Sht. 1, (Rev. 10, dated 8/96)
10	Vessel Vent System	H-2-98998, Sht. 1, (Rev. 10, dated 6/95)

Appendix D (SUPPORTING DOCUMENTATION)

D-1: TK-C-100 Leak Test Instructions

# PROCESS MEMO

PM# UN98-026 Page 1 of 6 EXPIRATION DATE: N/A

FROM: 200 Area Liquid Waste Processing Facilities Engineering PHONE: 373-4894 S6-72 March 27, 1998 TK-C-100 Leak Test Instructions

To: Shift Operations Managers

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R. R. Bloom	and the second	56-71
		S6-71
D. L. Flyckt		S6-71
J. L. Foster		S6-71
J. E. Geary		S6-72
R. J. Nicklas		
L' C' Mirrian		S6-71
J. M. Petty		S7-55
R. M. Gordon		\$6-72
N. J. Sullivan		S6-72
B. H. Von Bargen		S7-41
D. J. Williams		
		S6-72
R. A. Wahlquist		S6-72
M. A. Bowman		55-74
b A Selle		R1-56
C. E. Jensen		B7-₹1
S. R. Tifft		202011 (22
Process Memo File		2025EA/D3
Process Memo 1116		2025EA/05
200 Area LAPF RCC		

This Process Memo provides Leak Test instructions for the TK-C-100 as part of the 242-A Integrity Assessment. This test is being conducted under the overview of an Independent Qualified Registered Professional Engineer (IQRPE). It is not necessary for State inspectors to witness the test, nor is it necessary to notify the State of the date and time of the test. Results of necessary to notify the State of the Washington State Department of Ecology the leak test will be reported to the Washington State Department of Ecology with the final submittal of the 242-A Integrity Assessment.

The external portions of the components, piping, flanges and valves will be examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of Lagrangian accordance with the guidelines of ASME examined for evidence of Lagrangian accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of the guidelines of ASME examined for evidence of leaks in accordance with the guidelines of ASME examined for evidence of the guidelines of A

If any leaks are observed, follow-up engineering analysis shall be conducted to identify the type and extent of repairs required.

PM# LW98-026 Page 2 of 6

This test will encompass a fill to just below the High level alarm of the TK-C-100 tank as read on instrument WFIC-C100. The level will be filled to 65% as read on WFIC-C100 per TO-600-190 section 5.3. "Overflow TK-C-100 during shutdown". The following steps will not be performed in TO-600-190, 5.3.1. 5.3.2, 5.3.6, 5.3.8, 5.3.10-5.3.13. This procedure is designed to overflow TK-C-100, however, for this leak test it is only necessary to fill the tank to the 65% level. Perform steps 5.3.3, 5.3.4, 5.3.5, 5.3.7, and 5.3.9 ensuring that the level is only filled to 65% as read on WFIC-C100, NOT OVERFLOW.

This level will be maintained for a 24 hour hold period. The tank level at the start of the 24 hour hold period will be recorded and the tank level will be monitored every hour on WFIC-ClOB and recorded on Data Sheet #1.

System operator shall call QC at the start of the 24 hour hold time. (This call is to provide QC with an independent verification of 24 hour hold start time.)

Every four hours the tank will be walked down to determine if leaks are visible or whether liquid is accumulating on the floor of the condenser room, on the pipes, or equipment, and the results will be recorded on Data Sheet #2.

Small erratic up and down variations of liquid level can be due to expansion and contraction due to temperature changes, this would not be a cause for concern. However, a slow steady downward trend in level is more likely to be indicative of a leak.

If the water level begins to drop noticeably meeting the criteria established below, notify the 242-A cognizant engineer so an evaluation of the situation can be made. The engineer shall decide if continuing with the leak test is appropriate.

#### Leak Criteria:

Decreasing trend in TK-C-100 as read on WFIC-C100 level of 1% or more during the 24 hour hold period

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Any visual evidence of a leak discovered during an inspection of the tank and condenser room floor. Operations shall inspect the TK-C-100 tank every four hours during the hold period.

If no leak is visually verified and level is decreasing, a boundary valve check shall be made to verify integrity and determine if valves are leaking. Vessel may be filled to the 65% level as read on WFIC-C100 as long as the volume added does not exceed 500 gallons (approximately three and one half inches).

PM# LW98-026 Page 3 of 6

After a minimum of 24 hours, the QC inspector shall inspect the exposed portions of the TK-C-100 tank and connecting piping. The inspector shall examine external accessible areas of the tank paying particular attention to the welds. Joints, and seams. The visual examination will also be performed of the pipe surfaces next to structural supports for evidence of wear caused by vibration. The bottom side of the tank with the associated drain line will also be visually verified to have no leaks. Operations and QC inspectors will fill out Data Sheet #3 with visual inspection results.

After the completion of the visual examination and condensate drain line inspection, the 242-A cognizant engineer shall review the observations and accept or reject the results as identified by signature on data sheet #3.

The acceptance criteria for this test are NO DETECTABLE LEAKS.

Completed

JM 1 CHO.

Cognizant Engineer

MACHO FOR RI Nicklas

Cognizant Engineering Hamper or Delegate

Llavid A. M.

Operations Hamager or Delegate

Date

Delegate

Date

Cognizant Engineering Hamper or Delegate

Cognizant Engineering Hamper or Delegate

Descriptions Hamager or Delegate

Dete S-31-98

Cognizant Engineer

Date

PARE ENGROSES PAGE 40=10

# DATA SHEET #1 TK-C-100 TANK LEVEL INSPECTION

DATE	TIME	TANK LEVEL WFIC-C100	RECORDED BY
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NOTE: All DATES WITH AN " IN FRONT SHOULD be 4-29-98.

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# DATA SHEET #2 TK-C-100 4 HOUR VISUAL INSPECTION

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PH# LW98-026 PAGE 6 OF 6

### DATA SHEET #3

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TK-C-100 TANK LEAK TEST VT

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_ R.	Level IX	Signature	Date	
3			through 10/99	

D-3: Evaporator Vessel Integrity Test/Boiler Test

### PROCESS MEMO

PM# LW98-44 Page 1 of 10 EXPIRATION DATE: 10/1/98

From: 200 Area Liquid Waste Processing Facilities Process Engineering Phone: 373-4894/373-1151
Date: May 12. 1998
Subject: 242A Evaporator Vessel Integrity Test/Boiler Test

Shift Operations Managers

Ope. de. e		ac 74
B. D. Biddle R. R. Bloom		S6-74 S6-71 S6-71
D. L. Flyckt J. L. Foster	*	S6-74 S6-72
T. M. Galloto		S6-71
R. M. Gordon		\$7-55 \$6-72
M. D. Guthrie C. E. Jensen		R1-56 S6-72
E. Q. Le		S6-71
R. S. Mabry R. S. Nicholson		S5-05 S6-72
R. J. Nicklas J. M. Petty		S6 74 S6-72
N. J. Sullivan		B7-41
R H. Von Bargen		\$6-72 \$7 <b>-4</b> 1
D. J. Williams Process Memo File		2025EA/03 2025EA/05
200 Area LWPF RCC East Tank Farms Si	nift Office	S5-04
Fast lank Lating of		

### BACKGROUND

This Process Memo provides Leak Test instructions for the Evaporator Recirculation Loop as part of the 242-A Integrity Assessment and Boiler test. The Vessel Integrity Test is being conducted under the overview of an Independent Qualified Registered Professional Engineer (IQRPE). It is not necessary for state inspectors to witness the Integrity Test nor is it necessary to notify the state of the date and time of the test. Results of necessary to notify the state of the date and time of the test. Results of necessary to notify the state of the date and time of the test. Results of necessary to notify the state of the date and time of the Report (IAR), which will be retained in the 242A Evaporator Regulatory File.

The external portions of the components, piping, flanges, we'dls and valves will be examined for evidence of leaks. The walkdoms will be performed by pany account recharges an experience.

If any leaks are observed, follow-up engineering analysis shall be conducted to identify the type and extent of repairs required.

> PM# LW98-044 Page 2 of 10

Water will be the process solution used in the Evaporator Vessel CAl for testing. Integrity testing will be performed after the CAl Vessel is filled. At the completion of the integrity test, the JCI Package Boilers will be tested to verify adequate boiler capacity. After both tests are complete, the Evaporator vessel will be dumped to 102-AW. The corresponding East Tank Farms operational support has been specified in PM#

Total waste generation to tank farms is anticipated as follows (1 week estimated testing period):

- 27500 gal - 9600 gal -05 5000 gal CAl vessel fill (27500 gal)
PB1 seal water (7d\*.5 in/day\*2750 )
PD1271374 (278137 10.80)

Total waste generation to tank farms

(153 in)

TK-102-AW is limited to receive not more than 150,000 gallons from FY98 Evaporator Activities (Integrity Assessment + Boiler Test + Cold Run).

#### INSTRUCTIONS

NOTE -

Perform initial valve/electrical lineups/verification per TO-600-010 Perform Initial Valving Verification for 242-A Evaporator and TO-600-015 Perform Initial Electrical Verification for 242-A Evaporator.

Completed:

Install CAl vessel dump valve locking screws to prevent inadvertent loss of vessel contents during integrity assessment.

120 MAYAGE Date.

> PM # LW98-44 Page 3 of 10

3.0 Perform prestart operations per TO-600-025 Perform 242-A Evaporator System Status Check and Prestart Operation for Training.

W. 10 Notify Tank Farm SOM of upcoming PB-1 Seal Water flow to 102-AW.

3.2 Composite samplers do not require startup.

Completed: Bein balls / 5/31/48

4.0 Switch Seal Water System from filtered raw water to process condensate per TO-600-210 Operate PB-1 and PB-2 Seal Water Filter System 35 0 100 per 35 0 200 pe

Completed: Reichill , alies Date

5.0 Fill Vessel with raw water from slurry flush line using HV-CA1-2 per TO-650-140 Flush 242-A Evaporator Vessel and Recirculation Loop. TASK 5.1 to a level of 27,400 - 27,500 gallons as read on either LIC-CA1-1 or LIC-CA1-2. Whichever indicator is used to determine the initial level must be used throughout the Integrity Test and circled on Data Sheet #1.

5.1 Do Not Start PB-1 during the Integrity Assessment.

Completed: 50M Signature Date

### 6.0 INTEGRITY ASSESSMENT

### 6.1 HOLD PERIOD

This level will be maintained for a minimum 24 hour hold period. The vessel level at the start of the 24 hour hold period will be recorded and the vessel level will be monitored every hour on either LIC-CA1-1 or LIC-CA1-2, whichever was circled on Data Sheet #1 from step 5.0 above, and then recorded on data sheet #1.

The liquid level should remain constant throughout the 24 hour hold period, and no additional liquid should be required to maintain the level. Small, erratic, up and down variations in liquid level indication may be due to expansion and contraction due to temperature changes- this would not be cause for concern. However, a slow steady downward trend in level is more likely to be indicative of a leak.

> PM # LW98-44 Page 4 of 10

> > : - ::..

If the liquid level begins to drop noticeably, notify the 242-A cognizant engineer so an evaluation of the situation may be performed. The cognizant engineer shall decide whether to continue with the leak test. If either criteria listed in section 6.2 is met, the 24 hour hold period shall be terminated and the cognizant engineer notified.

- 6.2 ABORT CRITERIA
  - 6.2.1 Three successive hourly increases in the sump level totalling 1 inch or more, or, a cumulative level rise in the sump of 2 inches or more over the entire 24 hour hold period.
  - 6.2.2 Any visual evidence of a leak as viewed through the lead glass windows of the pump room. Visual observations will be conducted every four hours during the hold period. Results will be recorded on the C-A-1 four hour visual inspection data sheet #2.
- 6.3 CONDUCT VISUAL EXAMINATION FOR LEAKS

After a minimum of 24 hour hold time, a PRIC Sever desired anical inspection shall inspect the exposed sections of the 242A Evaporator Vessel and Reboiler and all connecting piping, flanges, welds, fittings and valves for signs of leakage. Also, inspect the SPC floor coating for signs of deterioration or wear. This information is recorded on Data sheet #3.

6.4 ACCEPTANCE CRITERIA

The acceptance criteria for this test is NO Detectable Leaks.

6.5 After completion of the visual examination the cognizant engineer shall review the observations and accept or reject the results (check appropriate blank an design attached data sheet).

Subsequently, the QC Inspector shall present the inspection results to  $\tilde{Q}A$ . If QA, QC, and 242A Operations agree that no leaks have been detected, proceed with this Process Memo.

- 7.0 After Integrity Assessment field activities are completed, reduce the level in the vessel.
  - ✓7.1 Notify Tank Farms SOM of intentions to empty apportunion of CAIsto
    - 7.2 Perform a partial-drawdown of CAI 50 102 AWBDY opening W. Shisa and montrol colons until the CAI bevelopes ches 24,500 22,500 galless readmin (CAI 51 on the AI 2).

Completed: SOM Signature , 6-3-98

PM # LW98-44 Page 5 of 10

- Perform TO-600-035 Start Up 242-A Evaporator for Training for Boiler 8.0 Test.
  - Establish vessel: vacuum at 60 TORR. 8.1
  - Deentrainer spray startup is optional. 8.2
  - NO slurrying out to 106-AW. 8.3
  - Record values on the Boiler Test Data Sheet during reboiler steam flow startup and in 55 200 tempers as read one file that during operation on the Boiler Test Data Sheet during reboiler steam programmer and in 55 200 tempers. 8.4
  - Continue Boiler Test by attempting to maximize steam flow through the reboiler, as condensate pressure allows.

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Terminate test after maximum boil-off is reached.

Shutdown Evaporator per TO-600-065 Shutdown 242-A Evaporator for Training and perform a controlled dump to 102-AW. 9.0

# OF THE REMOVE HIM WE'VE YOU'VE SET SET

- Notify. Tank Farm SOM prior to beginning the controlled dump. 9.2
- Do not transfer any liquid through the slurry line.

Completed:

> PM # LW98-44 Page 6 of 10

### MISCELLANEOUS

OSR Rounds

Filter changes/cleaning -

FH-filters and sockfilter changeout/cleaning should be conducted prior to swing shift.

FC-4 and FC-5 filters shall be changed per TO-600-180. Cleaning and switching the seal water sock filters is to be performed per TO-600-210.

OSR rounds shall be performed during the Boiler Test/Integrity Assessment.

160ncuranence 5-27-98
Copyliant Engineer Date

Sophiant Engineer Date

Sophiant States Date

Sophiant States Date

Sophiant States Date

Ball 6/5/88

SO Manager Date

JM Dath 6/5/88

Cognizant Engineer Date

PMH LUHS-044 PAGE 70F 10

DATA SHEET #1

EVAPORATOR VESSEL/RECIRCULATION LOOP LEVEL INSPECTION

			ē.
DATE TIME	(ICCAI-I)LIC-CAI-2	RECORDED BY	
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PM# LUAB-044 BAGE BOF 10

DATA SHEET #2

EVAP VESSEL/RECIRCULATION LOOP 4 HOUR VISUAL INSPECTION

7, 12	TIME .	OBSERVATION	RECORDED BY
DATE VOL		No Lonko	8CB
1/08 1/08	1230	NO Rocks	SLB
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13/14 V	1	NO (2.42)	450
4/2/44 WEX 98	03.20	No kaks	L Linker

PN# LW98-044 PAGE 9 OF 10

### DATA SHEET #3

"EVAPORATOR VESSEL/RECIRCULATION LOOP LEAK TEST VI . Time and Date when Vessel was Filled: 6/1/98 Time and Date when inspection began: (1) Connections: (1.1) From C-A-1; SEE COMMENTS PEON GOOD 6.348 . (1.2) To P-B-1: (1.3) From P-B-1: (1.4) To E-A-1: (1.5) From E-A-1: (1.6) To C-A-1: . Operations: <del>€</del>39€ WIEN BOW HANFOLD LEV. I -QC Inspectors: Comments: INSPECTION WALK DOWN COMPLETED DEA DIRECTION OF PROCESS MEMO PATELW98-44 SECTIONS 6.3 4 6.4 WAS ACCEPTABLE NO BBYIOUS LEAKS WERE DETECTED. To System and components are acceptable based on the inspection results. No further evaluation is required. System and components require further evaluation. Reference: Date: <u>6/5/98</u> 242-A Cognizant Engineer: Quality Assurance:\_ \$ SPC FLOOR CORTING SHOWED NO SIGNS OF DETERIOR FROM ON WEAR

### PM# LW18-04+ PAGE 10x0=10

,	+ Test	0%\$→	BOILER	TEST DA	ATA SHEE	:1 #4		•
	FIC-EA1-1 OUTPUT X	FIC-EA1-1 FLOV BATE	PRESSURE	PIC-CAS-7 DUFFIT X (CID)	PIC-CA1-7 PRESSURE (G10)	PI-EAI-13 PRESSURE (C13)	(CIE) STOCATE ST-ECS/EC3	but off e
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down from 27,213 - stablished Q 25,600 wenterings

PME LIESE-044 PAGE 1000E 10 2nd Test BOILER TEST DATA SHEET #4 100% -> 0% PIC-EA1-7 OUIPUT X (C10) 4 Afric SC blow days 28104 t Davie sou uants to getdune Ans co All of us com ajo to confety 900/ 11367 15,853 Kary 817 09 8013

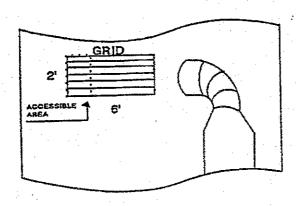
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D-4: NDE UT Thickness Measurement Procedure and Test Report

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LOCATION 3 14 APRIL 1998 C-A-1 EVAPORATOR

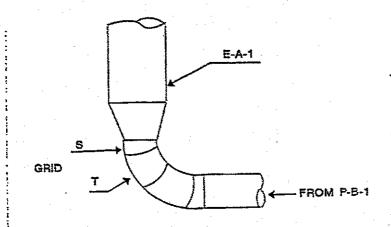


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AVERAGE = \$.384" (0.915)

NOTE: AREA WAS VERY INACCESSIBLE, NO SCAFFOLD WAS PROVIDED READINGS WERE TAKEN BELOW FLOOR GRATING SCAN AREA STARTED AT UPPER LEFT CORNER OF GRID, 24" DOWN AND 12" RIGHT

### LOCATION 5 14 APRIL 1998 LINE 1-1.2



DATA:(S)

1 1	A	_	U	
	.271"	.252	.253"	264
2	.269	.254	.257*	269*
	.268	.267*	.262*	.269*
-	TA (		1	
Г	A	В	С	ם
IT	.270"	.264	257	284"
2	.271*	.257	.262*	.265*
3	.269*	.258*	.260*	.269*
4	.269*	.263"	.259	.264
5	.270	.265	.262	.264*
6	.270*	.261*	.264*	.251*
Z	.263*	.265*	.260*	.264"
8	.265*	.264	.263	.269*
9	.272	.254*	.265	.266"
ΗO	.266*	.263*	.264	.263"
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Average 6.264 (0671cm)

AVERAGE() = 0.265" (0.673 cm)

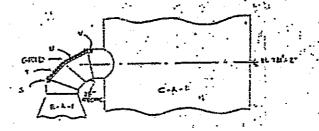
### LOCATION 7 14 APRIL 1998 LINE 1-1.4

DESCRIPTION: C. MIDE TONE TENEM OF MILESED EFFORM LO EXTERNO 24 OF

eych Ziņe

GRID: , 2" GRID

SKETCH.



DATA:(V)
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Ur	1120-1	* /		
	Α	В	С	D
1	.250	.249*	.249	.250°
2		.248	.248	.250*
2	254*	.241*	.239"	.245*
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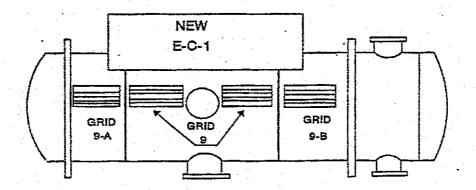
Α	В	C.	D
.256*	248	246	.246
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.259*	257"	.256*	.252
.247*	.255*	.254*	_,252
	.256*	.253°	.252
	.252	.251	.252
	.257*	.251	.249*
.251*	.251	.252*	.2501
.251"	.252*	.253	.2501
	<u> </u>		
<del>                                     </del>			
	.256* .253* .259* .247* .248* .253* .257* .251*	A B .256' .248' .253' .251' .259' .257' .247' .255' .248' .256' .253' .252' .251' .251'	A B C .256" .248" .246" .253" .251" .250" .259" .255" .256" .247" .255" .254" .248" .256" .253" .253" .252" .251" .257" .257" .251" .251" .252"

AVERAGE(1) = \$.252"
(0.640 cm)

DATA (S)

1		Α	В	C	B
1	1				
1	2		$\rightarrow$		
	3				

## SKETCH



E-C-1 23 APRIL 1998 LOCATION 9A

DATA

	A	В	С	D	Ε	F	G	н	1	J	к	L	М
1	.511"	.511*	.510	.513	.512*	.513°	.512'	.513*	.515*	511	.513*	.514	.518
2	510	.509"	.535"	.513	.513	.513*	.516'	.517	.514"	.513	514	515*	.516*
3	.514*	.512"	.511"	.514"	518	.515	.520	.523"	.516"	.514*	.518*	.516'	,519°
4	.510	.513*	.512"	.513"	.524	.513"	.517"	.519*	.517"	.515°	.518'	.517	.517
5	.512*	.514*	.516*	.516	.517*	.517	.518"	.522*	.519*	.516*	.520*	519	521
6	.511*	.510	.513*	.515	.514"	.514"	.514"	.517	.515°	.514"	.515	.516*	.519"
7	.511*	.516	.516	.515"	.518	.515*	.516"	.516*	.513*	.514	.515"	.515	.518
8	.513"	514"	.518'	.516"	.519*	.516'	.515*	.515"	.515*	.518"	.516*	.514°	.518*
9	.513	.518	.514*	.514	.517*	.516"	.515	.514"	.513	.516*	.513*	.514	.516
10	.513*	.512*	.512'	.515	.517*	.517	.515"	.521"	.515*	.515*	.515*	.513"	.516
11	.511*	512	.513"	.514"	.517*	.518"	.521"	.521*	.521*	.518*	.516*	.520	.522*

AVERAGE (4) = 0.515" (1.308 cm)

### E-C-1

LOCATION 9

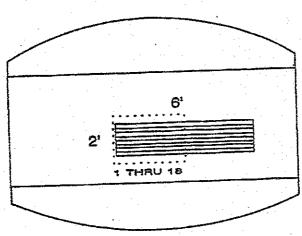
14 APR 1998

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5						.514"	.510*	.512"	,512'	.516°	,512°	.515"	.516*
6			<u> </u>			.512	.508	,512'	.513*	.511*	.511*	.513*	,517°
7					<u></u>	510"	.510*	.511"	.510	.510"	.512*	.512*	.514*
8						,513*	.512*	.511	.511"	,510°	.510°	.512	.516*
9						.517	.513	.515	.511	.510	.515	.511	515*
10						508*	.508	.509*	.510	.509*	.512*	.511	514*
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		OCA	(TIOI	N 9	E1	F1	G1	Н1	11	LO <sup>4</sup>	CATI K1	ON S	(1.300 M1
	A1	B1	· · · · · · · · · · · · · · · · · · ·		E1 .519*					J1 .523*	K1 .520°	ON 9	M1 .519
AT/			C1	Di						LO <sup>4</sup>	K1 .520* .521*	ON 9 L1 .519	M1 .519*
AT/	A1 .514*	B1 .515*	C1 .516°	D1 517°	.519*					J1 .523* .522*	K1 .520* .521*	ON 9 L1 .519 .522	M1 .519* .523*
AT/	A1 .514' .513'	B1 .515* .517*	C1 ,516°	D1 .517*	.519* .522	F1	G1_	н		J1 .523* .522* .523*	K1 .520* .521* .524* .521*	ON 9 L1 .519 .522 .519	M1 .519* .523* .516*
AT/ 1 2 3	A1 514' .513' .513'	B1 .515*	.516° .516°	517° .520°	.519* .522 .520*	F1		н		523° 523° 523° 523° 523°	CATI	ON 9 L1 .519 .522* .519* .519*	M1519*523*516*517*
AT/ 1 2 3	A1 .514* .513* .513* .514* .516*	B1 .515* .517* .515* .518*	C1 .516° .516° .517° .520°	517° .520° .517° .520°	,519° ,522 ,520° ,518°	F1	RE/	н	н	J1 .523* .522* .523*	.520° .521° .521° .521° .519°	ON 9 L1 .519' .522' .519' .518' .528	M1 .519* .523* .516* .517* .517*
1 2 3 4 5	A1 514' .513' 514' 516' 518"	515° 517° 518° 518° 519°	.516° .516° .517° .520°	517° .520° .517° .520°	.519* .522 .520* .518*	F1	RE/	Н1	н	J1 .523* .522* .523* .522* .522*	.520° .521° .521° .521° .521° .519°	519° 519° 519° 519° 519° 519° 518° 518° 518°	M1 .519 .523 .516 .517 .517 .518 .518
AT/ 1 2 3 4 5 6	A1 514' .513' .513' .516' .516' .518'	515° 517° 518° 518° 518° 518° 519°	C1 516° .516° .517° .520° .519°	D1 517° .520° .517° .520° .520° .520°	.519° .522 .520° .518° .525°	F1 A	RE/	Н1	н	523° 522° 522° 522° 522° 521°	.520° .521° .521° .521° .521° .519° .519° .518°	ON 9  L1 .519 .522 .519 .519 .523 .517 .517 .516	M1 .519* .523* .516* .517* .517* .518* .515*
1 2 3 4 5 6 7	A1 514" 513" 514" 516" 518" 515"	515° 517° 518° 518° 519°	516° .516° .517° .520° .519° .519°	517° .520° .517° .520° .520° .520° .520° .520°	.519° .522 .520° .518° .525° .519°	F1	RE/	Н1	н	522° 522° 522° 522° 521° 521° 5512°	.520° .521° .524° .521° .519° .519° .518° .518°	519° 519° 519° 519° 519° 519° 519° 5119° 5119° 5119° 5119° 5119° 5119° 5119° 5119°	M1 .519* .523* .516* .517* .517* .518* .515* .515*
AT/ 1 2 3 4 5 6 7 8 9	A1 514' .513' .513' .516' .516' .518'	515° .517° .518° .518° .519° .516° .518°	C1 516° .516° .517° .520° .519° .519° .519°	517° .520° .517° .520° .520° .520° .520° .521° .521° .517°	519° .522 .520° .518° .525° .518° .522°	F1	RE/	Н1	н	523° 522° 522° 522° 522° 521°	.520° .521° .524° .521° .519° .520° .518° .518° .518°	519° 519° 519° 519° 519° 517° 517° 516° 516° 516° 516° 517° 516°	M1 .519 .523 .516 .517 .517 .518 .515 .515 .515 .515 .515

# E-C-1 14 APRIL 1998

٦	Ni	01	P1	Q1	Ri	Si	71	U1	V1	Wi	X1	Y1-	Z1
_	.520°	.520*	.616"	.516	.516'	.517	.518"	,515*	.517		1		
,	517"	517*	.516"	.515*	515	517	.514"	.517	.516*				$\angle$
 3	516'	.515*	.517*	.515°	.513"	.514"	.507*	.515*	.516"				
4	517*	.517	.516"	.517	.517*	,515"	.518*	.518*	.517*		<u> </u>		
5	518"	525*	.526*	.519*	.518*	.515	.514	.516*	.513		$\Delta$	/_	
6	.519*	.517	.516	.512"	,516"	.515*	.515;	,513"	.516*		}		
7	515	.515"	.518"	.513"	.513*	.514*	.514"	.514*	.514*				
8	515*	.514"	.515	.511*	.511	.513*	.513*	.514*-	.518"			$-\lambda$	
9	.513	.514"	.511	.517*	.514*	.513*	.513*	.515°	.518	/			\
	513"	512	.515*	.513*	.515*	.512"	,513	,515*	.517				_
	540	E12	.514"	.514	.513"	.514"	.513*	.519*	.517*	/			
	1	NOTE:	A LOW	READIN	G OF .1	41° W/	AS FOU	ND JUS	TLEFT	OF G1-	ı Hi	elage	= <u>#2.51</u>
۸7	A												(1.3110
A]	A			1 _	· · · · · · · · · · · · · · · · · · ·	CATION	19-B	APRI	L 23 98	! !		. 1	
A7	A	В	С	D	E	CATION F	(9-B	APRI H	53, 98	J	к	L	М
A7		B .516*	C 515*	D .515*	· · · · · · · · · · · · · · · · · · ·	CATION	G .509°	APRI H	23 98 i	ال 508*	K .505°	L .512"	
1	Α	1	1		E	CATION F	(9-B	APRI H	.510°	.508* .510°	,505°	L _512*	M .506*
	A .519*	.518"	.515*	.515*	.513*	F .511*	G .509°	APRI H .510" .511"	.510°	J .508* .510*	K .506° .510°	L .512* .508*	,506° .509°
1 2	A 519* 517*	.516* .517*	515	.515°	.513* .513*	511°	9-B G .509*	APRI H .510*	.510° .510° .511° .511°	.508* .510* .512*	510° 513° 519°	.512° .508° .509°	M .506* .509* .508*
1 2 3	519* 517* 520*	.518* .517* .519*	.515° .514° .517°	.515° .514°	.513* .513* .514*	512° .513°	9-B G .509* .511*	APRI H .510" .511"	.510°	J .508* .510*	K .506° .510°	L .512* .508* .509* .515*	M .506° .509° .508° .511°
1 2 3 4	A 519* 517* 520*	.518* .517* .519*	515* 514* 517*	.515° .514° .515°	.513* .513* .514*	511° .512° .513°	9-B G .509* .511* .512*	APRI H .510° .511° .510°	.510° .510° .511° .511°	.508* .510* .512*	510° 513° 519°	.512° .508° .509°	M .506° .509° .511° .508° .504°
1 2 3 4 5	A 519* 517' 520' 522'	518" 517" 519" 520" 518"	515° 514° 517° .517° .514°	.515° .514° .515° .517° .514°	513" 513" 514" 514"	512° .513° .512°	.509° .511° .512° .514° .511°	APRI H .510° .511° .510° .511°	.510° .511° .511° .511°	.508* .510* .510* .510*	513* .519*	L .512* .508* .509* .515*	M .506° .509° .511° .508° .504°
1 2 3 4 5 6	A 519° 517° 520° 522° 522°	518* 517* 519* 520* 518*	515° 514° 517° 517° 514° 515°	.515° .514° .515° .517° .514°	513" 513" 514" 514" 514"	511° 512° 512° 512° 512°	9-B G .509° .511° .512° .514° .511° .512°	APRI H .510° .511° .510° .511° .510°	.510° .510° .511° .511° .511° .511°	.508* .510* .512* .511* .509*	513° .519° .519° .509°	L .512* .508* .509* .515* .509* .509* .509*	M .506° .509° .511° .508° .504° .509°
1 2 3 4 5 6 7	A \$19" 517" 520" 522" 522" 5224"	\$18* 517* .519* .520* .518* .518*	515° 514° 517° 514° 514° 515°	.515° .514° .517° .514° .513°	E .513* .514* .514* .514* .515* .513*	511° 512° 512° 512° 512° 512° 5515°	9-B G .509° .511° .512° .514° .512° .512° .512°	APRI H .510° .511° .510° .511° .510° .509°	.510° .511° .511° .511° .511° .511°	.508* .510* .512* .510* .511* .509*	.505° .510° .513° .513° .509° .511°	L .512* .508* .509* .515* .509* .509* .509*	M .506° .509° .508° .501° .508° .509° .509° .509°
1 2 3 4 5 6 7 8 9	A 519° 517° 520° 522° 522° 522° 522°	518* 517* .519* .520* .518* .518* .518*	.515° .514° .517° .514° .515° .515°	.515° .516° .515° .517° .514° .513° .516°	E .513" .514" .514" .515" .514" .514"	CATION F .511° .512° .512° .512° .512° .512° .512° .512° .512° .512° .512° .512°	9-B G .509° .511° .512° .514° .512° .512° .512°	APRI H .510° .511° .510° .511° .510° .509°	1 .510° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511° .511	.508° .510° .512° .511° .509° .511°	510° 513° 513° 519° 509° 511° 509°	L .512* .508* .509* .515* .509* .509* .508*	M .506° .509° .508° .501° .508° .509° .509° .509°

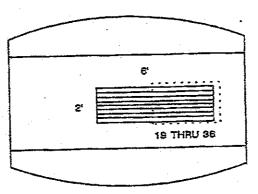
TK-C-100 14 APRIL 1998 LOCATION 11



AVERAGE = 0.326 (0813cm)

						1			9	10	11	12	13	14	15	16	17	18
_	1	2	3	4	5.	6	7	8					0001	.328*	.324"	.324"	.323	.327*
4	325*	325*	324	323	.324"	324,	.325	.324"	.326	.330"	,327*	325*	.325*	ر معد	.027			
3	322"	322	322	323"	353,	322	.322	322	.325*	.3291	.325	.325	.321°	.324*	.322'	.322	.322	.326
•		-		1	321	322	,323"	323	.324*	.324*	.324*	.326*	.324*	.823	.323	.321*	.323°	.324
<u> </u>	321	322'	322	320	1	<del> </del>	1	1	.323	.323	.322	.322	,320*	.322	.320	.321	.320	.322
D.	322	320	321	319	319	319*	322	350,	.520	-	<del> </del>				1	.321	322	.322
E	321	321	322	319"	321"	320	320	.322*	.322	.322	322	.323*	.321	.321°	.321*	.021		<del> </del> -
F	1	321	319"	315	315	320	320,	.320	.322"	.321	.321	.323	,828	.321	.318	,320	.321*	32
_	321	1321	+-	1-	+	+-	0.71	319	.321"	320	.322	.322	.321	.321	.316	.319	.318	.32
G	319*	322	318"	317	318	318	.\$17*	215	1.02.	†	1	1		.320	- 318	.319	.319	.32
н	321*	324"	322	316*	317	319*	.318*	.319	.319	.320	.319	319	320	1 320		<del> </del>	<del>                                     </del>	1
-	+	┼─	0.00	315	317	315	.316	317	.316	.319	.318	.318'	.316	.316	.315	,317	.317	.31
Ľ	315	328	322*	13.2	1-		1		1	319	.318	.318	.318	.315	.315	.318	.320	.31
J	320*	315	324*	315	315	316	.316	.318'	,315	+	+		-	1	.312	.313	.312	.31
K	314"	314"	316	314	314	314	.313	314	.316	316	.315	,316	.315	1012		1	1	+
	1	_	313	314	312	313	.313	314	315	.315	.315	.314	.313	31	.312	31	314	.31

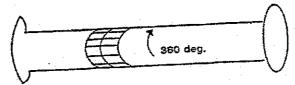
TK-C-100 14 APRIL 1998



Average = 0.321" (0815cm)

7	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	327	.327*	.325*	.326"	.329	.326'	.325	327	.327"	.328*	.327*	.326*	.329*	.329"	,325°	.325*	.325*	.324
3	.324"	.323*	323*	.823*	.324*	.324"	.328"	.325*	325*	.325²	.325	.326"	,325°	.825*	.325	.322	.323*	.327
C	.326*	.524"	.324*	.323	.322	.324"	.326*	,325'	,324	.324	,324*	.322	.324"	.324*	,323"	.322*	.323*	.325
 D	.322	.323*	.322	.321*	,333*	.322*	.323*	.324°	.326"	.3231	,323*	.523*	.323*	.322*	.321*	.822	.321	.822
E	.321*	.32C*	.320*	.319*	.324"	.322	.322'	,321'	.522	,323*	.323*	.324	.523	.322	.322	,322*	.322	.822
F	'351°	.319*	.318*	.319*	.319*	219	.820"	.322*	.320"	.320*	,324"	.322	.321*	,321*	.318	.318*	.320	.319*
G	.321	317*	,319 <sup>2</sup>	,317	,319*	.3191	320"	,319°	.320*	322	.522*	.320*	.323	.321	,321	.318	.319	.320
H	.321	318*	319"	.318*	.319"	.317*	.318'	.318"	,319*	.321*	.321*	.324	.825	.319	.318	.318	.317	.323
1	.320*	318"	.318*	.316	.315	.317'	.5191	,318°.	.320	.321*	,321*	.324	.323	,318	,318	.319	.817	.318
j	318"	.317	,318*	.316	.318*	.317"	.320	317	.316°	320	.315*	.315	.318	.315	.319	.318	317	.317
K	316	.315		.313"	1-	.314	.316'	,317	.315	.317	.319	.317	.315	.316	.316	.315	.314	.31
	.815*	1		1	1	<del>                                     </del>		.313	.314	314	.315	.315	.319	.317	.315	.314	.315	.31

#### E-C-2 14 APRIL 1998 LOCATION 12



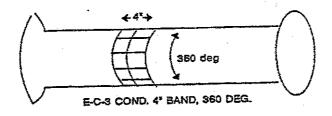
E-C-2 COND. 4" BAND 360 DEG.

Γ		Α	l	3	<u>C</u>			
۲	1	.838*	1.3	28"	3	31"		
}	2	.332		340	3	33°		
,		.336	Т.	35	3	38		,
1		340	1.3	341"		40	Ì	-
1	5	.337	T.	347°.	1.3	36	l	
-	6	344	٦,	352'	1 .	340		
t	7	334	_	341	Ŀ	333°	]	
ŀ	B	.331	-: 1	327	1	3211	1	
ŀ	Š	326	- 1	327	1.	315	1	
ľ	10	330		326	1:	320	1	
ţ	11	.327		328	١.	322		
Ì	12	.323		315		319	1	
1	13	323	_	314		311	<u>.</u>	J.
-	14	.315		.314"		312	•	
	15	.317		,318	I	.314	]	
	16	328		.320	_	.319	-	
	17	.32		.320		.330	<u>.                                    </u>	
-	18	.81		.316		.313		
	19	.32		.310		.31	31	
	20	.32	_	.313		.32	4"	٠.
	21	L31		.314	•	.32	3°	
٠.	22			.31		33	1"	
	23			.329	—·	,33	<u>e  </u>	
	20			.329		.33	5°	
	25			.32		.33	ō,	
		- <del> -</del>		1			- ;	
	-							L

NOTE: E-C-2 COVERED W/ THICK PAINT

AVERAGE = (0.826 cm)

> E-C-3 14 APRIL 1998 LOCATION 13

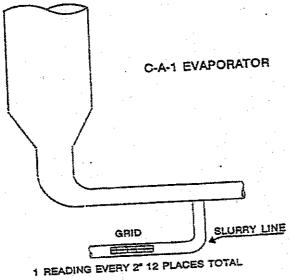


NOTE: C-C-3 GOVERED WITH THICK PAINT

	Α	В	C	
1	341*	.328*	.343"	
2	.332*	.230*	.328*	
3_	.349*	.347"	.349*	
4	.341*	.348	.334*	
5	.331*	,332*	.334"	
6	.352	.360	.352*	
7	.348*	.351"	.350	
8	.338*	,340	_351°	
9	.340"	.334*	,350*	į
10	.336*	.341*	.354*	
11	.332*	.337*	.336*	1
12	.339*	.338*	.336*	1
13	.333*	.338"	,339	1

AVERAGE = 0.341" (0.866 cm)

LOCATION 15 14 APRIL 1998 LINE 1-3.5



AUCRAGE = 0.137"
(0.348cm)

ם	ATA		
Γ		Α	
Γ	1	,136"	
۲	2	.135*	]
۲	2 3	.135"	1
r	4	.136"	]
۲	4 5 6	.136*	1
ŀ	6	.137*	]
ŀ	7 8 9 9 10	.137"_	]
f	8	.137"	]
١	9	.137"	
	9	.138"	
1	10	.138"	
-	41	.138"	
	12	1.136*	

TK-C-100 DRAIN LOCATION 16 14 APRIL 1998

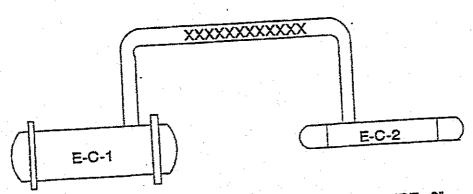
TK-C-100

TK-C-100 TO LERF, 12 POINTS ALONG PIPE, 2" SPACE

	DATA	
1.	.227"	
2.	.223"	
3.	.219"	
4.	.218"	
5.	.218 <sup>u</sup>	
6.	.215	
7.	.213"	
8.	.211"	· · · · · ·
9.	.213"	
10.	.213"	
11.	.216"	(
12.	.214	

AVERAGE = 0.217" (0.551 cm)

> LOCATION 17 4/23/98 LINE FROM E-C-1 TO E-C-2



12 INDIVIDUAL READINGS ALONG PIPE, 2" SPACE

	DATA	· .			
1.	.309' .315'		-		
3. 4. 5.	.310° .311" .320"				
6. 7. 8.	.299" .318" .319" .316"		Average =	\$.313°	(0.795 cm)
9. 10 11	0104				

Appendix E (CORROSION STUDY)



### FLUOR DANIEL INTEROFFICE CORRESPONDENCE

Shenn Tifft

Date

June 16, 1998

Hanford

Reference:

1998 Interim 242-A Evaporator

Tank System Integrity

Assessment Plan

From:

Tet

Cathy Sharpay

Locations

Irvine

Client:

Walankant

(949)975-5137

Subject:

Approval of May 1998 Corresion

Evaluation Report

FAX Number: (949)975-7178

I have reviewed the "1998 Interim 242-A Evaporator Tank System Integrity Assessment Plan", the "1998 UT Results (Report)" and the May 18, 1998 "Corrosion Evaluation" report. The effects of radioactivity have not been evaluated as this was addressed during the original design and we were not provided the nesessary data to update this part of the materials analysis.

I certify that I have examined and am, familiar with the information submitted in the "Corrosion Evaluation" report. I believe that the information is true, accurate and

Cathleen A. Sharpay

Technical Director, Materials and Welding

Registered Professional Engineer

California State PE Registration # CR001053

9/30/00

(Original signed and sealed)



#### FLUOR DANIEL INTEROFFICE CORRESPONDENCE

Sherm Tifft

Date:

May 18, 1998

Hanford

Reference:

1998 Interim 242-A Evaporator

Tank System Integrity Assessment Plan

. .

Ali A. Darwish

Client

To:

(949)975-2929

Subject

Corresion Evaluation

FAX Number: (949)975-7178

Irvine

**c**::

Cathy Shargay

A corresion evaluation based on the 1998 Interim 242-A Evaporator Tank System Integrity Assessment Plan 1998 (IAP) and the 1998 ultrasonic testing (UT) results was performed to examine the compatibility of the materials used and the commodities being handled. The scope of this evaluation is limited to the equipment and piping sections listed in the Thickness and Corrosion Rate Table of this report.

The 1998 UT inspection did not cover all equipment and piping sections that were inspected in 1993. As a result, corrosion rates for locations 1, 2S, 2T, 4, 6, 10, and 14 could not be obtained.

As for the equipment that were inspected, not all grid points were measured. Therefore, for every equipment, an average thickness was calculated for the grid points measured and compared to the average thickness of the 1993 comparable grid points to make the corrosion rate calculations more accurate. For example, the 1993 average thickness (Tavg) for Location 3 is based on the average of readings from A1 to L6 only.

The nominal thickness (Tnom) minus the mill tolerance in the table are based on Table 1 of WHC-SD-WM-ER-124 Rev 1. One exception is that for TK-C-100, a minimum required thickness based on the ASME allowable stress has been calculated and is shown on page 6.9-3 of WHC-SD-WM-DP-019 Rev. 6.



### FLUOR DANIEL INTEROFFICE CORRESPONDENCE

Sherm Tifft May 18, 1998 Page 2 of 3

#### Conclusion

Materials of construction as described in Table 2 of WHC-SD-WM-DP-019 Rev. 0 are compatible with the service conditions described in Table 4.2a and Table 4.2b of the 1998 IAP. Wall thicknesses of equipment and piping are above the Thom minus the mill tolerance which is the minimum thickness expected during original construction. Corrosion rates are also negligible or within acceptable limits (<5 mpy). Hence, all equipment is acceptable for the next five years.

One concern is that Paragraph 4.3 of the 1998 IAP states "... and the portions of concrete structures that may come in contact with the waste are coated with a chemically resistant acrylic coating (Carboline D3358 primer and Carboline D3359 topcoat)". However, Carboline D3358 and D3359 are not recommended for immersion services. It is recommended that several concrete coating/lining manufacturers (Ameron, Stonehard, Plasife, Koch) be consulted for recommendations on the optimum concrete lining for this service.

The UT inspection during the next IAP should include all accessible equipment and grid points that were tested in 1993 so that a more extensive comosion rates can be evaluated and and a more exhaustive remaining equipment life can be established.

#### **FLUOR DANIEL** INTEROFFICE CORRESPONDENCE

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#### Thickness and Corrosion Rate Table

Location	Equipment	Material	Nominal Toom, kt	Trion - MSI Tolerance , in	1993 Readings Tevg, in	1995 Readings Yevy, in	Corresion Reto, MPY	1993 Readings Tenin, in	1995 Readings Troin, in	Minimum Remaining Life (Note 5)
				0.32	0,381 (Note 1)	0.384 (Fole I)	0	0,35	9,351	>20
3	C-A-1	55	0.375	0,205		0,265 (Note 2)	0	0,244	0,252	>20
5	Line # 1-1.2	86	0.25	0.205	0.25 (Note 3)	D.252 (Note 3)	0	0.223	0,239	<b>≯20</b>
7	Line # 1-1.4	58	0.25	0.203	0.522 (Note 4)		1.4	0.489	9,507	13.5
9	E-C-1	G8	0,5	0.161	0.310	0.32	0	0.309	0.312	>20
- 11	TK-C-100	55	0.3125	-	0,333	0.326	1.4	0,314	0.31	>20
12	E-C-2	CS .	0.3125	0,273	0.345	0.341	0.6	0.334	0,325	>20
13	E-C-3	CS CS	0,322	0,282	0.137	0.137	0	0.135	0.135	×20
15	the#1-3.5	55	0.134	0.117		0.217	0	6.206	0,211	>20
18	Line#4,33	Ç\$	0.210	0.189	6,212		<u>~</u>	0.3	0.309	>20
17	1.foe # 2.4	Ċ5	0.26	0.245	0,306	0,313		L		I

- Notes:
  1. Average for thickness readings from A1 to L6.
  2. Average for Section T thickness readings from A1 to D10.
  3. Average for Section U thickness readings A1 to D9.
  4. Average for thickness readings from A1 to M11.
  5. This remaining life is based on the minimum measured thickness (in 1993 or 1998), the average corrosion rate and the Thom Mill Tolerance thickness. When this thickness is approached, an actual Tmin based on the design pressure and applicable codes can be determined, which will probably indicate a significantly greater remaining life.

A. Darwish Ali Darwish

1998 Interim Integrity

866T s Interim Assessment HNF-2905, 242-A Tank Rev. System Report o

# carboline

# CARBOLINE® 3358

grant product data sheet

# SELECTION DATA

GENERIC TYPE: primer. onent water-borne acrylic

GENERAL PROPERTIES: A high performance, direction metal acrylic primer which can tolerate a variety of topcasts. Carboline 3258 has exceptional film strength and chemical resistance.

- Excellent flexibility
  Excellent corrosson protection
  Excellent resistance to flash rusting
  Helts the most stringent VOC (Voletile Organic
  Content) regulations
  Authorized by USDA for incidental Food Contact
- COMMENDED USES: As a primer for applications quiring a VOC compliant primer such as galicur, tank teriors and structural steel. Can be used as a two three coast all acrylic system with Carboline 3339 poset.

NOT RECOMMENDED FOR: Immersion service.

PICAL CHEMICAL RESISTANCE
IT appropriate topocat)
Spissal &
Scale &
Spissal &
Spissal &
Spissal &
Spissal &
Spissal &
Very Good
Wents Pair Excellent

(PERATURE RESISTANCE Non-imm brueus: 236°F (113°C) Cominuous: 400°F (204°C)

\*At 250°F and above, slight discoloration and loss of gloss is observed.

COMPATIBLE COATINGS: May be applied over most rightly adhering coatings. Normally topcoated with Carboline 3359. Consult Carboline Technical Service for specific recommendations. SUBSTRATES: Apply over suitably prepared metal concrete or other surfaces as recommended.

# SPECIFICATION DATA

THEORETICAL SOLIDS CONTENT:

CARBOLINE 3358

June 94 Replaces Nov 91

8y Volume 37% ± 2%

POLATILE ORGANIC CONTENT:\* Martine 24

Potable Water thirmed 5% with Addition 102 Acorder 10% with y si 1.5 268 72.5

RECOMMENDED DRY FILM THICKNESS PER COAT:\* 2.3 mas (60-75 microns) (Ref: SSPC PA 2) Aputhe Alfa Astra

Additional thickness may be required over fough sixtages for appearance. Dry film thickness in excess of a missicoat is not recommended.

THEORETICAL COVERAGE PER GALLORI\*
579 m2 sq. tt. (14.1 sq. m/l at 25 microns)
152 sq. tt. at 3 mis (4.7 sq. m/l at 75 microns)

Wixing and application losses will vary and must be taken into consideration when estimating job require-ments.

STORAGE CONDITIONS: Stere indoors. Temperature: 40-11015 (4-4315) Harrister: 0-95%

KEEP FROM FREEZING

MATERIAL 24 m the when stored at 75% (24%).

## CLOSS: Sain ORDERING INFORMATION

Prices may be obtained from your local Carboline Sales Representative or Carboline Customer Service Depart-

CARBOLINE 3358: Surface Cleaner Additive # 102 NE SEE NG WEIGHT 50 Gal. Drum 565 lbs. 1257 kg) N/A 538 lbs. (244.5 kg)

FLASH POINT: (Setaliash)
CARBOLINE 3358:
Additive # 102
Surface Cleaner #3 7200°F 

SAMESS ON MATURE, STATUTORS,

# APPLICATION INSTRUCTIONS Carboline® 3358

The instantians on set immised to show product and subsidies presentials. It is seasoned that the pr test the standard.

mineria in considerate with SSPC-SP1 with clean rage of in Thinnes at a Coulement East-SP1 with clean rage of in Thinnes Lat a Coulement East-self didowed by a rapi frame with clean potable were. A print cont case of dwer intogenic time painers.

Power mit anii uniom in ce st entrikment.

Ritz: May be thirmed up to 5% by volume with cleer, a wester where conditions dictate. Areas with cost wester where conditions can expensione a satisfact conditions can expension. Such a satisfact three conditions. But 3 200% (volume) of Addition \$102 sesists in the proper sion at the recommended DFT, without euris Refer to specification data for VOC information.

FOTLER: This is a single component pro-ndefinite working time. Keep containes or the.

Do not apply when the surface temperature is less than 5%, see 30%, 30% and 10%, and 50% My for all the surface than policy. See dig at 10% My for minutes after application. Washelves produce seedlike to moisture during cuts. Do not apply if temperatures are expected to drop below 50% (10%) within 24 bours of application.

June 24 Replaces Nov 37

Spacial thirning and application 1 above or below normal conditions

COLLEY APPLICATION: Use a short wowen map symbst class and apply over smooth well suffices and shoot moves. For nout, suffered, under block or vary porsy moves, use a 245° wowen hap symbotic roller. Multiposes runy be sequited over rough suffered:

RUSK APPLICATION: Use a synthetic briefle cats will be required in order to achieve desir ass and ecceptable hiding characteristics.

SPALY: Province equipment with undiluted Surface Cleane IS before specific. The following aprey equipment has been count satisties and is evaluable from manufacturers such a linta, DaVibles and Greco.

Pressure pot equipped with dusi regulators. Nat hose, .086" fluid tip and apprepare air 15. m

30:1 (min) 2.0 (min) 3/2" 1.0. (min) .017".019" 1800-2200 60

DRYMG TDAEE: These times are at the ilm thickness 13.0 milet.

Dry to Hearding

daffoccost and fine currien son sate. ph hunding, high film thickness or sphere Dry to Handle/fopcost are iver water evaporation tate. Cohe th form.

CAUTION: READ AND FOLLOW ALL CAUTION STATEMENTS ON THIS PRODUCT DATA SHEET AND ON THE MATCHAL SAPETY DATA SHEET FOR THIS PRODUCT.

rep above 32% spc., employ normal workmaning safety precautions. Use with to wear gloves or lise protective cream on face and hands if hyperstristive, need not in use. In case of spillage absore and dispose of in accordance with local



# carboline

# CARBOLINE® 3359

# SELECTION DATA

GENERIC TYPE: Single companies: The companies of the comp	topoost.  GENERAL PROPERTIES: A durable, high performance GENERAL PROPERTIES: A durable, high performance appoints and chemical sestimance are required. Carbo proposities and chemical sestimance are required. Carbo proposities and chemical sestimance and acquired over a variety of tightly addesing primes arousting inorganic since.
NEE.	
<b>6</b>	a draga

		Curability
2000	Coversal	Excellent
•		

- cition (Votatile Organia
  - Content regulations
    Authorized by USDA for incidental Food Contact
    Available in Rapid Tint colors
- RECOMMENDED USES: As a topocat for a variety of priners where a VOC compliant topocat is required priners where a VOC compliant topocat is required butch se salicars, tank exteriors and enturnal steel. NOT RECOMMENDED FOR: Immersion service

Excellent Excellent Good Excellent Excellent TYPICAL CHEMICAL RESISTANCE:
Splach & Sollbar.
Sollbar.
Sollbar.
Addit Very Good Alcaines Very Good Solvents Excellent Salt Excellent Excellent Excellent Excellent

•At 250°F and above, slight discoloration and loss of glass is observed. COMPATIBLE COATMIGS: Can be applied over a variety of primets including increasing alloyders applied, epochatic volys and unchannes, upda over applied, epochatic volys and unchannes, upda over applied as a two or fires coat system consett Carboline Technical Service for specific recom-SUBSTRATES: Apply over suitably prepared metal, concrete or other surfaces as recommended. nersion]\*: ERATURE RESISTANCE (No. 235°F (113°C) Continuous: 600°F (204°C)

REGRETCAL SOLDS CONTENT:

By Volume 23259
36 # 2%

June 54 Repisces Nov 91 Carboline 3359

Per Activel	약 [A 경	27°0	1	122	PER COAT
Calculated DA	132	351	55	727	A THICKNESS TREE: SSPC F
E3"	100	polisa)	Bertoel p.f.	Pediadi i	Ty with color. D DRY FILL S microns!
VOLATLE ORGANIC CONTENT: Calculation	As supplied:	Thinned 5% with Poteble Weter	Trinned 5% with Additive #102	Thirmed 10% with the spal Additive #102 pil	**************************************

ng and application losses will vary and must be into possideration when estimating job require-THEORETICAL DOVERAGE PER GALLON:\* 579 mil st. ft. ft4.1 sq.m/ at 25 microns/ 192 eq. ft at 3 mils fk.7 sq.m/ at 75 microns/

STORAGE CONDITIONS: Sport troosts. 40-310°F it-43°C! tompostum: 40-310°F it-43°C! Humidity: 0-95%

SHEF LIFE: 24 months when stored at 75°F (24°C) COLOR: Available in a venery of polors. Contact your local Carboline Sales Representative or Carboline Customer Service Department for availability. KEEP FROM FREEZING

ORDERING INFORMATION GLOSS: Ser

Prices may be obtained from your local Carboline Sale Representative of Customer Service Representative. APPROXIMATE SHIPPING WEIGHT:

57c Doors 57 bos. 525 bos. 123 kg) 1239 kg) 40 bos. N/A (18 kg) 538 bos. 21.8 kg) (244.5 kg) 50 Ge. 525 BS. 1236 kg) V2004 NE SE SE FLASH PONT: Esetlashi CARBOLINE 3359: Additive #102 Surface Cleaner #3 Surface Cleaner #3 CARBOLINE 3359 Additive #102

**1998** Integrity Interim 242-A Tank Assessment HNF-2905, Report Rev. System

# APPLICATION INSTRUCTIONS

# Carboline\* rine. They are beautiful at an and it determining entroll and are presented as

FACE PREPARATION: Apply over clean, dry memored primer. Remove all dirt, oil, grease and anthunis in accordance with SSPC-SP1 with clean applicate. Themer 2 or Surface Cleaner? Swed by a thorough riese with clean, potable water, ast cost may be required over acceptance since

NG: Power mix until uniform in consistency. I excessive air entrainment.

Hannesto: May be thinned up to 5% by volume with Hannesto possible water where conditions dictate. Areas with cool substrate and warm ambient conditions can operience a surface skinning and separation. Under here conditions, the use of 5-10% (volume) of haddine #102 assists in the proper film formation at the recommended DFT, without surface skinning-had to specification data for VOC information.

se of thinners other than those supplied or applicated Carboline may adversely affect product performance of void product warranty, whether express of implied.

POTLIFE: This is a single component product which has an indelimite working time. Keep container cov-

to not apply when the surface temperature is less than 5°F, or 3°C above the dew point. Keep dry at 15°F, and 50% RH for 90 minutes after application. Standard department and expected to site. Do not apply if temperatures are expected to sop below 50°F (10°C) within 24 hours of application.

ecial thirring and application technique whet above or below normal conditions. may be

COLLER APPLICATION: Use a short woven nap synthesic soller and supply over smooth wall surfaces and boncers. For rough surfaces, cinder block or very bocours surfaces, use a 358° woven nap synthetic ober, Muhiple coats may be required over rough ober, Muhiple coats may be

have 94 Replaces Nov S1

BRUSH APPLICATION: Use a synthetic bristle brush. Two costs will be required in order to achieve desired two chiefuness and acceptable hiding characteristics.

SPRAY: Pre-rince equipment with unditated Surface Cleaner #3 before spraying. The following spray equipment has been found suitable and is available from manufacturers such as Binks, DeVilbiss and

Conventional: Pressure pot equipped with flual regula-tors, 1/2" I.D. material hose, a .086" fluid tip, and appropriate air cap.

Altiests
Pump Ratio:
GPM Quiput:
Material Hose: 30:1 (min) 3.0 (min) 3,8" LD. (min) .017".019" 1800-2200

To Size: Output ps:: The Size:

For two or I more pick-ups,

or ease of application using airless spri smove the pick-up tube and immetse t irectly into the material. nandacurer.

DRYING TIMES: These times are at the dry film thickness (3.0 mils).

16-10-13 110-13 50-F [10-13] 75-F [24-13] 90-F [32-13] pry to Handle and Topopet 3 hours 2 hours 1 hours

High humidity, high film thickness or codier tempera-tures will lengthen Dry to Handle/Topcost and final cure times due to slower water evaporation rate. Cohesive strength will develop with time.

CLEAN UP: Use clean potable water, followed with suitable solvent to dry equipment.

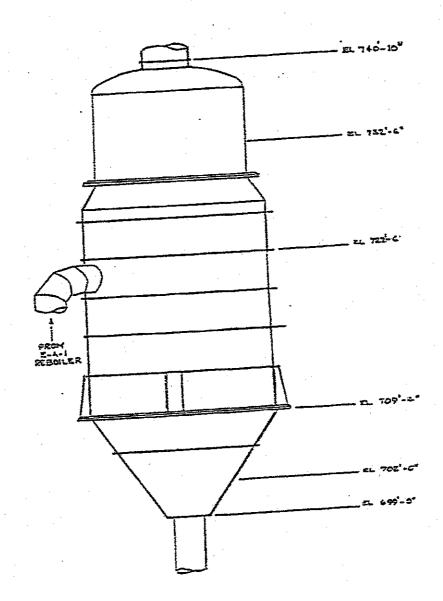
CAUTION: READ AND FOLLOW ALL CAUTION STATEMENTS ON THIS PRODUCT DATA SHEET AND ON THE MATERIAL SAFETY DATA SHEET FOR THIS PRODUCT.

Water-based Product, Keep above 32"f (D'c), Employ Normal Workmanlike Safety Precautions, USE with Discollife Ventilation and Wear Gloves or USE protective Cream on face and hands if kypersenstive, Keep Dontainer Closed Widen not in USE, in case of spillage, absorb and dispose of in accordance with local Applicable regulations.

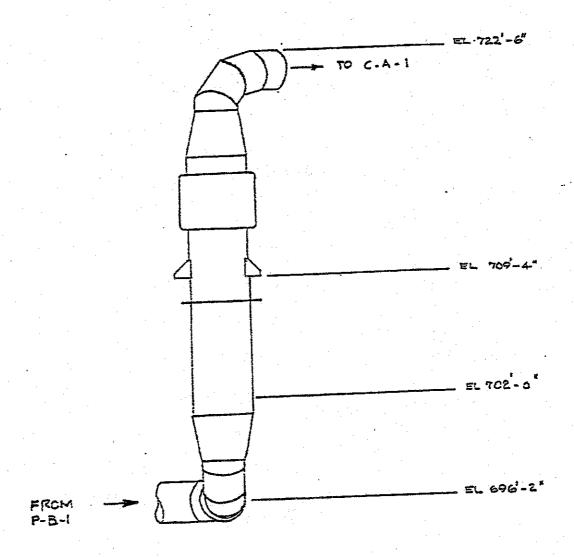
carboline.

APPROPRIES . St. Land HOEST-64

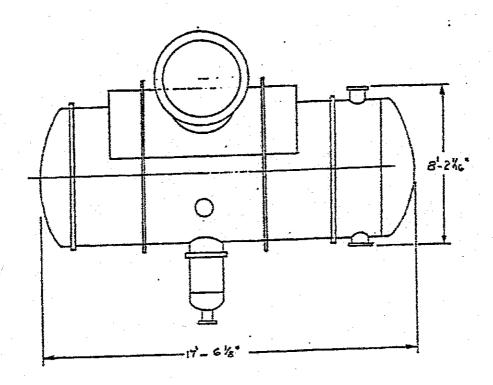
Appendix F (FIGURES)



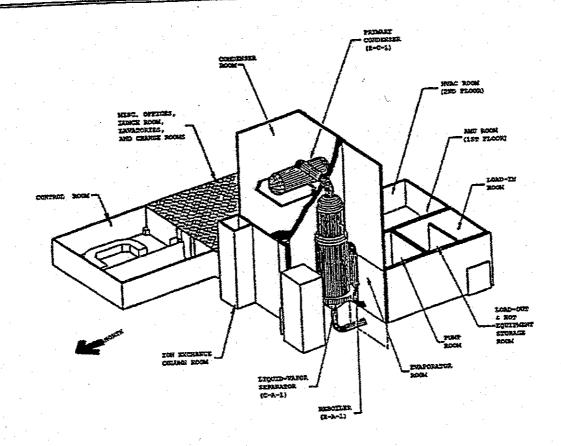
C-A-1 EVAPORATOR CRYSTALLIZER



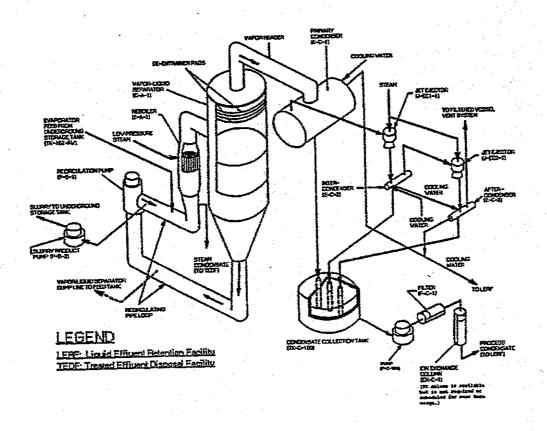
E-A-1 REBOILER



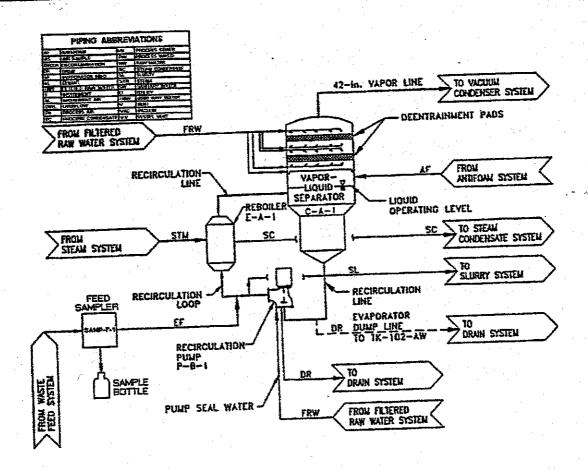
## E-C-1 CONDENSER



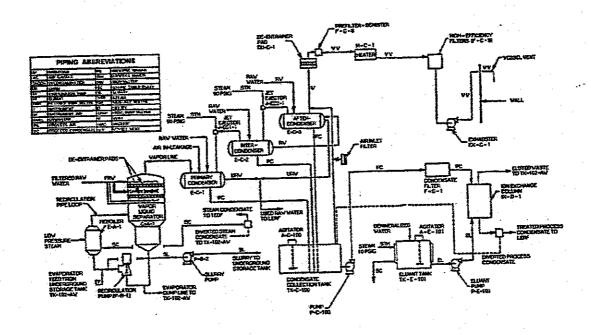
242-A Evaporator Perspective



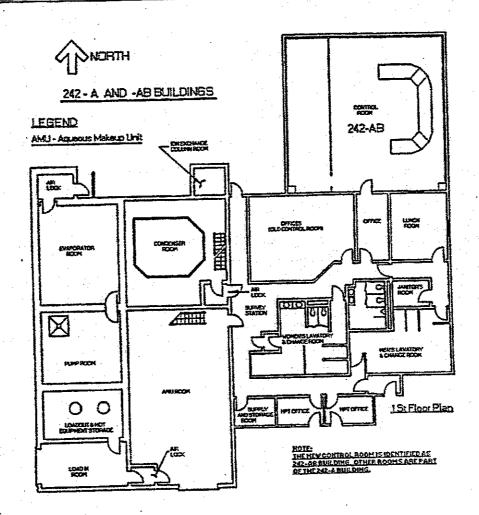
242-A Evaporator Simplified Schematic



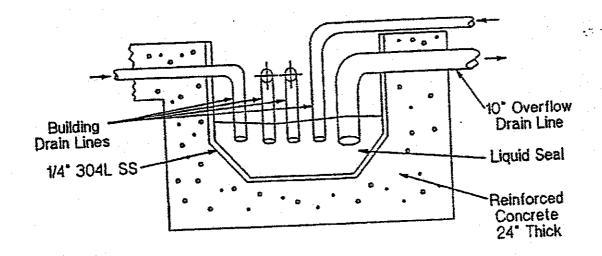
242-A Evaporator Process Loop



242-A Evaporator Simplified Process Flow Diagram



242-A Evaporator First Floor Plan



242-A Pump Room Sump Schematic

Appendix G (DESIGN PARAMETERS)

Table G-1: Operating Parameters

Component	Pressure/Flow	Temperature (F)
C-A-1 Evaporator Vapor Section Lower Circulation Pipe	<0.8 psia 16,000 gpm	120 200
<u>B-A-1 Reboiler</u> Tube Side (Waste) Shell Side (Steam)	16,000 gpm 29.7 psia	250
E-C-1 Primary Condenser Tube Side (Cooling Water) Shell Side (Waste Vapor)	2,800 gpm 0.8 psia	72 95
E-C-2 Intermediate Condenser Tube Side (Cooling Water) Shell Side (Waste Vapor)	150 gpm 1.0 psia	72 150
E-C-3 Final Condenser Tube Side (Cooling Water) Shell Side (Waste Vapor)	150 gpm 14.0 psia	95 170
TK-C-100 Condensate Catch Tank	14.0 psia	151

Table G-2: Equipment Design Criteria

COMPONENTS		DESIGN CRITERIA	COMMENTS	
C-A-1 Evaporator	Standard(s): ASME Section VIII Div. 1, HPS 230W & 220W		Designed by Struthers Nuclear and Process Co.	
	Temperature:	200°F		
	Pressure:	Full Vacuum		
	Materials:	ASTM SA 240 304L (Shell)		
	Reference:	Construction Spec. B-100-P1, SD-WM-TI-003		
E-A-1 Reboiler	Standard(s):	ASME Section VIII Div. 1, HPS 230W & 220W	ASTH SA 312 304 (NOZZLES)	
	Temperature:	350°F (Shell), 250°F (Tubes)		
	Pressure:	100 psig (Shell), Full Vacuum (Tubes)		
	Materials:	ASTM SA 240 304L (Shell)		
	Reference:	Construction Spec. 8-100-P1, SD-WM-TI-003		
P-B-1 Recirculation Pump	Standard(s):	Not Specified	New Installation per Project B-534	
	Temperature:	200 <sup>o</sup> F		
	Pressure:	Not Specified		
	Haterials:	ASTM A296 Gr CF-8 and GrGF-8		
	Reference:	Procurement Spec. 8-534-P4		
	Capacity:	14,000 GPM		

COMPONENTS	DESIGN CRITERIA	COPPERTS	
P-B-2 Bottoms Pump	Standard(s): Not Specified	New Installation per Project B-534	
	Temperature: Not Specified	_	
	Pressure: Not Specified .		
	Materials: Stainless Steel		
	Reference: Procurement Spec. 8-534-P11		
E-C-1 Primary Condenser	Standard(s): ASME Section VIII Div. 1, HPS 220W	SA 515 GR70 (Tube Sheets). Original unit is being replaced by unused spare on Project B-5	
	Temperature: 150°F(Shell and Tubes)		
	Pressure: Full Vacuum (Shell), 100 psig (Tubes)	_	
	Materials: SA285 GrC (Shell Heads, Internal Supports)		
	Reference: Construction Spec. 8-100-P1		
E-C-2 Intermediate Condenser	Stendard(s): ASME Section VIII Div. 1, TEMAC		
	Temperature: 350°F(Shell and Tube)		
	Pressure: 100 psig to Full Vacuum (Shell), 100 psig (Tube)	_	
	Materials: Carbon Steel		
	Reference: Shutte and Koerting Co. Spec. Sheet 72-T-018-J-1		

COMPONENTS		DESIGN/CRETERIA	CONNENTS	
E-C-3 Final Condenser	Standard(s):	ASME Section VIII Div. 1, TEMAC	1	
	Temperature:	350 <sup>o</sup> F	_	
	Pressure:	100 psig to Full Vacuum (Shell), 100 psig (Tube)		
	Materials:	Carbon Steel	1	
	Reference:	Shutte and Koerting Co. Spec. Sheet 72-T-018-J-1		
TK-C-100 Condensate Catch	Standard(s):	ASME Section VIII Div. 1 & HWS 4311, Rev. 2	Modified in 1977 per ASME Sec. VIII Div. 2 New material ASIM A312 Type 304. 1124 Gallon	
Tank	Temperature:	Not Available	capacity.	
	Pressure:	5 psig		
	Materials:	347 SS		
	Reference:	H-2-69357 & H-2-40704		
IX-D-1 Ion Exchange Column	Standard(s):	ASME Section VIII Div. 1	Fabricated in 1977. Corrosion allowance 1/16	
	Temperature:	150°F	Mesh Screens 304 or 316 SS	
	Pressure:	120 psig	Mesh Screens 304 of 310 33	
	Materials:	Carbon Steel (ASTM A36 & A285 GrC)		
	Reference:	H-2-69359		

COMPONENTS	DESIGN CRITERIA	COMMENTS	
TK-C-103 Condensate Measurement Tank	Standard(s): ASME Section VIII Div. 1	500 Gallon tank	
	Temperature: Not Available		
	Pressure: Atmospheric	The second secon	
	Materials: ASTM A36 (Wier Plate ASTM A240 304L)		
	Reference: H-2-69370		
Seal Pot, Liquid Seal	Standard(s): ASME Section VIII Div. 1	27 Gallon tank	
	Temperature: Not Available		
	Pressure: Atmospheric		
	Materials: ASTM A36 CS		
	Reference: H-2-69368		
Building/Structure	Standard(s): UBC, 1972	Seismic Design Loads: Horizontal, 0.25g DBE/0.125g OBE, Vertical, 2/3 horizontal. Coated with phenoline 305 chemically resistar	
	Temperature: N/A		
	Pressure: N/A	coating.	
	Materials: Poured in-place concrete		
	Reference: Structural Dwgs. H-2-69276 thru 85 and H-2-69269 thru 75 and H-2-90739 thru 41		

### Table G-3: Pipe Materials (PER VITRO SPEC B-100-C1)

SYSTEM ESIGNATOR	MATERIAL							
Ml	ASTM A53, TYPE E OR S, GR A OR B, OR ASTM A106, GR A OR B							
M2	ASTM A53, TYPE E OR S, GR A OR B, OR ASTM A106, GR A OR B							
M5	ASTM A53, TYPE E OR S, GR A OR B, OR ASTM A106, GR A OR B							
M7	ASTM A53, TYPE E OR S, GR A OR B, OR ASTM A106, GR A OR B							
M8	ASTM A312, TP304L							
M9	<pre>≤12": ASTM A312, GRTP304L, ≥14": ASTM A240, GRTP304L</pre>							
M21	SS 304L, PER HPS-124-M							
M24	ASTM A53, TYPE S, GR B, OR ASTM A106, GR B							
M25	ASTM A53, TYPE S, GR B, OR ASTM A106, GR B							
M27	SS ASTM A312, TYPE 304L							
M31 (TUBING)	.035" WALL THK, ASTM A269, GR TP304							
M32 (TUBING)	POLYETHYLENE, SINGLE LINE OR BUNDLED & SHEATHED IN PVC							
M33 (TUBING)	COPPER ASTM B68							
M42	ASTM A53, TYPE E OR S, GR A OR B, OR ASTM A106, GR A OR B							

Table G-4: 242-A Evaporator Bulk Chemistry Solutions

escription	Units	Evaporator Feed	Double Shell Slurry Feed	Process Condensate	Cooling Water	Steam Condensate
oH Ho	••	13.0	13.0	10.0	6.2	8.0
roc I	mg/L	3.3 E+03	4.6 E+03	2.6 E+02	1.7 E+00	1.1 E+00
DS	mg/L	0.0 E+00	0.0 E+00	3.4 E-01	0.0 E+00	7.6 E+01
Alpha	uCi/ML	0.0 E+00	2.9 E+11	5.7 E-11	8.1 E-10	6.5 E-10
Beta	uCi/ML	0.0 E+00	3.5 E-10	6.8 E-13	1.0 E-08	00 E+00
AlO <sub>2</sub>	mg/L	2.2 E+04	3.2 E+04	4.1 E+01	OD E+00	00 E+00
NR <sub>4</sub>	mg/L	9.3 E-02	1.3 E+02	2.3 E+03	00 E+00	6.3 E-02
Barium	mg/L	9.8 E+00	1.4 E+01	3.0 E-02	3.0 E-02	3.1 E-02
Baron	mg/L	1.2 E+01	1.7 E+01	3.5 E-02	0.0 E+00	1.8 E-02
Calcium	mg/L	5.1 E+01	7.3 E+01	1.9 E+01	1.9 E+01	1.9 E+01
Cadmium	mg/L	1.1 E+01	1.6 E+01	3.1 E-02	2.0 E-03	0.0 E+00
co <sub>3</sub>	mg/L	8.7 E+03	1.2 E+04	2.4 E+01	0.0 E+00	0.0 E+00
Cl-	mg/L	4.5 E+03	6.4 E+03	2.4 E+01	7.8 E-01	1.1 E+00
Chromium	mg/L	4.2 E+02	6.0 E+02	3.4 E-02	1.0 E-02	0.0 E+00
Copper	mg/L	4.8 E+00	6.9 E+00	1.5 E-02	7.3 E-02	1.1 E-02
CN	mg/L	3.4 E+01	4.8 E+01	9.5 E-02	0.0 E+00	0.0 E+00
F	mg/L	2.7 E+02	3.9 E+02	4.3 E-02	0.0 E+00	1.3 E-01
Iron	mg/L	2.8 E+01	3.9 E+01	8.5 E-02	1.0 E-01	8.4 E-02
H <sub>2</sub>	mg/L	1.6 E-11	1.7 E-11	2.0 E-11	0.0 E+00	0.0 E+00
OH_	mg/L	4.9 E+04	7.0 E+04	1.4 E+02	0.0 E+00	0.0 E+00
Lead	mg/L	5.1 E+01	7.0 E+01	4.6 E+00	1.3 E-02	5.5 E-05
Magnesium	mg/L	2.0 E+01	2.9 E+01	4.6 E-01	4.3 E+00	4.5 E+00
Manganese	mg/L	2.0 E+01	2.9 E+01	5.8 E-02	1.1 E-02	1.4 E-02
Mercury	mg/L	5.6 E+00	8.0 E+00	1.6 E-02	0.0 E+00	1.1 E-04
Molybdenum	mg/L	4.2 E+01	6.0 E+01	1.2 E-01	0.0 E+00	0.0 E+00
Nickel	mg/L	2.8 E+01	4.0 E+01	7.9 E-02	1.1 E-02	0.0 E+00
NO <sub>3</sub>	mg/L	1.2 E+05	1.8 E+05	6.1 E+01	1.2 E+00	5.5 E-01
NO2	mg/L	6.0 E+04	8.6 E+04	7.0 E+01	0.0 E+00	0.0 E+00
PO <sub>4</sub>	mg/L	3.7 E+03	5.3 E+03	1.0 E+01	0.0 E+00	0.0 E+00
Phosphorus	mg/L	3.4 E+03	4.9 E+03	9.6 E+00	0.0 E+00	0.0 E+00
Potassium	mg/L	1.3 E+04	1.8 E+04	1.0 E+01	8.0 E-01	7.5 E-01
Silicon	mg/L	1.3 E+02	1.9 E+02	5.9 E-01	0.0 E+00	2.5 E+00
Sodium	mg/L	1.7 E+05	2.4 E+05	1.6 E+01	2.3 E+01	2.2 E+00
so <sub>4</sub>	mg/L	2.0 E+03	2.9 E+03	5.0 E+00	1.0 E+01	1.0 E+01
Tungsten	mg/L	1.5 E+02	2.1 E+02	4.1 E-01	0.0 E+00	0.0 E+00
Uranium	mg/L	5.3 E+01	7.5 E+01	1.5 E-01	6.4 E-04	5.2 E-04
Zinc	mg/L	3.4 E+01	4.8 E+01	9.6 E-02	4.8 E-02	1.9 E-02

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